656.25
R13m
Supp.
1939

25 Sept 39

ASSOCIATION OF AMERICAN RAILROADS
SIGNAL SECTION

INSTRUCTIONS FOR INSERTING ADDITIONS AND REVISIONS TO MANUAL

Complete to 1939 Annual Meeting

Approved by General Committee, Engineering Division,
July 10, 1939.

Approved by Association of American Railroads,
July 25, 1939.

IMPORTANT—READ CAREFULLY

Enclosed herewith will be found all subject-matter adopted by letter ballot June 7, 1939, this material having been submitted for such action at the 1939 Annual Meeting.

Before inserting the enclosed subject-matter, see that the title pages now in your Manual read as follows:

"Complete to 1938 Annual Meeting."

If the title pages do not conform to this, your Manual is not up-to-date, and you should purchase the necessary Additions and Revisions from the Secretary.

The instructions, as shown on the following pages, are intended as a guide for inserting all new matter, substituting revisions, and removing all obsolete matter, and if carefully followed will bring your Manual up-to-date.

It must be understood that such portions of existing matter now in the Manual that have not been affected by any revision, or have not become obsolete, are to remain intact; where revisions have been made to any sheet or sheets in existing matter, it will be necessary to substitute such sheet or sheets.

In order to differentiate between new, revised and obsolete matter, the following terms are used:

INSERT—New matter not previously shown.

SUBSTITUTE—Existing matter to be removed and revisions inserted.

NO CHANGE—Existing matter to be left in its present location.

OBSOLETE—Matter that has either been incorporated elsewhere or superseded by new matter. Such sheets are to be taken out.

Care must be taken where matter is to be substituted, to be sure that only the pages affected by the change are removed before the new matter is inserted, as in some cases the original may consist of two or more pages, whereas the revision may be confined to one page, or vice versa.

New matter and revisions to existing matter now in the Manual are shown in CAPITAL LETTERS.

All items which should appear in the Manual are shown in the following list, and a check should be made to see that your Manual agrees as to titles,

PRINTED IN U. S. A.

number of pages for each item, and the order in which they appear. Should your Manual contain any items which are not listed, such subject-matter has previously been made obsolete and should be removed. If any of the items or pages listed do not appear in your Manual, same should be purchased from the Secretary at once.

SPECIFICATIONS, ETC.

TITLE PAGE—One page—SUBSTITUTE.
Preface—One page—NO CHANGE.
INDEX—Paging 1 to 32—SUBSTITUTE FOR Paging 1 to 30.
Blue Sheet, Part 1—NO CHANGE.
  Application of Signals—Paging 1 to 14—NO CHANGE.
Blue Sheet, Part 2—NO CHANGE.
  ALTERNATING CURRENT GENERATOR—SPECIFICATION 73-39—Paging 1 and 2—SUBSTITUTE FOR SPECIFICATION 7332—Paging 1 and 2—Paging 3 to 6—NO CHANGE.
Blue Sheet, Part 3—NO CHANGE.
  PORTABLE ALTERNATING CURRENT AMMETER—SPECIFICATION 112-39—Page 1—SUBSTITUTE FOR SPECIFICATION 112-35—Page 1—Paging 2 to 4—NO CHANGE.
Blue Sheet, Part 4—NO CHANGE.
  TYPE "B" COPPER-OXIDE CAUSTIC SODA PRIMARY CELL—SPECIFICATION 171-39—Paging 1 to 3—SUBSTITUTE FOR SPECIFICATION 171-36—Paging 1 to 3—Paging 4 to 6—NO CHANGE.
Blue Sheet, Part 5—NO CHANGE.
  AUTOMATIC BLOCK SIGNAL SYSTEM—SPECIFICATION 63-36—Paging 1 to 9—NO CHANGE—Paging 10 and 11—SUBSTITUTE—Page 12—NO CHANGE—Page 13—SUBSTITUTE—Paging 14 to 21—NO CHANGE.
Blue Sheet, Part 6—NO CHANGE.
  TYPE "A" COPPER-OXIDE CAUSTIC SODA PRIMARY CELL—SPECIFICATION 87-39—Paging 1 to 7—SUBSTITUTE FOR SPECIFICATION 87-36—Paging 1 to 6.
Blue Sheet, Part 7—NO CHANGE.
  Installation and Maintenance of Copper-Oxide Caustic Soda Primary Cells—Instructions—Paging 1 to 5—NO CHANGE.
Blue Sheet, Part 8—NO CHANGE.
  Maintenance and Operation of Direct Current Track Circuits—Instructions—Paging 1 to 4—NO CHANGE.
Blue Sheet, Part 9—NO CHANGE.
  BATTERY JAR—SPECIFICATION 113-39—Paging 1 to 3—SUBSTITUTE FOR SPECIFICATION 11328—Paging 1 to 3.
Blue Sheet, Part 10—NO CHANGE.
  Signal Protection for Spring Switches—Requisites—One page—NO CHANGE.
Blue Sheet, Part 11—NO CHANGE.
  AIR DEPOLARIZED DRY CELL—SPECIFICATION 170-39—Page 1—SUBSTITUTE FOR SPECIFICATION 170-36—Page 1—Paging 2 to 5—NO CHANGE.
Blue Sheet, Part 12—NO CHANGE.
  ELECTRIC LAMP CASE—SPECIFICATION 174-39—Page 1—SUBSTITUTE FOR SPECIFICATION 174-38—Page 1—Paging 2 to 4—NO CHANGE.
Blue Sheet, Part 13—NO CHANGE.
  Specification for Electrolyte—One page—NO CHANGE.
Blue Sheet, Part 14—NO CHANGE.
  Installation, Maintenance and Operation of Lead Acid Type Storage Batteries—Instructions—Paging 1 to 16—NO CHANGE.

Blue Sheet, Part 15—NO CHANGE.

NICKEL, IRON, ALKALINE STORAGE BATTERY—SPECIFICATION 49-39—Page 1—SUBSTITUTE FOR SPECIFICATION 49-34—Page 1—Paging 2 to 5—NO CHANGE.

Blue Sheet, Part 16—NO CHANGE.

Installation, Maintenance and Operation of Nickel, Iron, Alkaline Storage Batteries—Instructions—Paging 1 to 12—NO CHANGE.

Blue Sheet, Part 17—NO CHANGE.

Specification for Bolts, Nuts and Threads—One page—NO CHANGE.

Blue Sheet, Part 18—NO CHANGE.

LEAD ACID STATIONARY STORAGE BATTERY—SPECIFICATION 53-39—Paging 1 to 6—SUBSTITUTE FOR SPECIFICATION 53-34—Paging 1 to 5.

Blue Sheet, Part 19—NO CHANGE.

LEAD ACID STATIONARY STORAGE BATTERY—SPECIFICATION 58-39—Page 1—SUBSTITUTE FOR SPECIFICATION 58-34—Page 1—Paging 2 to 5—NO CHANGE.

Blue Sheet, Part 20—NO CHANGE.

PARKWAY CABLE—SPECIFICATION 145-39—Page 1—SUBSTITUTE FOR SPECIFICATION 14532—Page 1—Paging 2 to 17—NO CHANGE.

Blue Sheet, Part 21—NO CHANGE.

DIRECT CURRENT VIBRATING HIGHWAY CROSSING BELL—SPECIFICATION 44-39—Page 1—SUBSTITUTE FOR SPECIFICATION 44-35—Page 1—Paging 2 to 6—NO CHANGE.

Blue Sheet, Part 22—NO CHANGE.

TRACK CIRCUIT RAIL BONDING—SPECIFICATION 135-39—Page 1—SUBSTITUTE FOR SPECIFICATION 135-38—Page 1—Paging 2 and 3—NO CHANGE.

Blue Sheet, Part 23—NO CHANGE.

Requirements for the Protection of Traffic at Movable Bridges—Paging 1 to 3—NO CHANGE.

Blue Sheet, Part 24—NO CHANGE.

AERIAL ALUMINUM CABLE STEEL REINFORCED—SPECIFICATION 54-39—Page 1—SUBSTITUTE FOR SPECIFICATION 54-34—Page 1—Paging 2 and 3—NO CHANGE.

Blue Sheet, Part 25—NO CHANGE.

AERIAL BRAIDED CABLE—SPECIFICATION 89-39—Page 1—SUBSTITUTE FOR SPECIFICATION 8933—Page 1—Paging 2 to 16—NO CHANGE.

Blue Sheet, Part 26—NO CHANGE.

ARMORED SUBMARINE CABLE—SPECIFICATION 90-39—Page 1—SUBSTITUTE FOR SPECIFICATION 9032—Page 1—Paging 2 to 16—NO CHANGE.

Blue Sheet, Part 27—NO CHANGE.

CAR RETARDER SYSTEM—SPECIFICATION 147-35—Paging 1 to 17—NO CHANGE—Page 18—SUBSTITUTE—Paging 19 to 26—NO CHANGE—Page 27—SUBSTITUTE—Page 28—NO CHANGE.

Blue Sheet, Part 28—NO CHANGE.

LEAD-COVERED CABLE—SPECIFICATION 91-39—Page 1—SUBSTITUTE FOR SPECIFICATION 9132—Page 1—Paging 2 to 15—NO CHANGE.

Blue Sheet, Part 29—NO CHANGE.

Forecast of the Value of Signaling—Form 24—One page—NO CHANGE.

Blue Sheet, Part 30—NO CHANGE.

ELECTRO-PNEUMATIC SWITCH OPERATING MECHANISM—SPECIFICATION 152-39—Paging 1 to 9—SUBSTITUTE FOR SPECIFICATION 152-38—Paging 1 to 8.

Blue Sheet, Part 31—NO CHANGE.

SPECIFICATION FOR NO. 6 DRY CELL—One page—SUBSTITUTE.

Rq Engrg 21 & 39 Direct 1039220. = Cont

- Blue Sheet, Part 32—NO CHANGE.
  - CHANNEL PINS—SPECIFICATION 23-39—Page 1—SUBSTITUTE FOR SPECIFICATION 23-37—Page 1—Paging 2 and 3—NO CHANGE.
- Blue Sheet, Part 33—NO CHANGE.
  - Circuit Nomenclature and Written Circuits—Paging 1 to 11—NO CHANGE.
- Blue Sheet, Part 34—NO CHANGE.
  - Automatic Block Signaling Circuits—Requisites—Paging 1 to 3—NO CHANGE.
- Blue Sheet, Part 35—NO CHANGE.
  - AUTOMATIC GATES—HIGHWAY CROSSINGS AT GRADE OVER RAILWAY TRACKS—REQUISITES—Paging 1 and 2—INSERT.
- Blue Sheet, Part 36—NO CHANGE.
  - FIBROUS-COVERED NON-METALLIC SHEATH FOR RAILWAY SIGNAL CABLE—SPECIFICATION 161-39—Page 1—SUBSTITUTE FOR SPECIFICATION 161-37—Page 1—Paging 2 to 5—NO CHANGE.
- Blue Sheet, Part 37—NO CHANGE.
  - Specification for Fibre Conduit—One page—NO CHANGE.
- Blue Sheet, Part 38—NO CHANGE.
  - Specification for Communication Underground Conduit Construction—One page—NO CHANGE.
- Blue Sheet, Part 39—NO CHANGE.
  - STEEL PIPE CONDUIT—SPECIFICATION 3613—Paging 1 and 2—NO CHANGE—Page 3—SUBSTITUTE—Page 4—NO CHANGE.
- Blue Sheet, Part 40—NO CHANGE.
  - WROUGHT IRON PIPE CONDUIT—SPECIFICATION 3713—Paging 1 and 2—NO CHANGE—Paging 3 and 4—SUBSTITUTE.
- Blue Sheet, Part 41—NO CHANGE.
  - Specification for Vitrified Clay Conduit—One page—NO CHANGE.
- Blue Sheet, Part 42—NO CHANGE.
  - Signaling for Gravity Classification Yards—One page—NO CHANGE.
- Blue Sheet, Part 43—NO CHANGE.
  - REFLECTOR UNIT—SPECIFICATION 156-39—Page 1—SUBSTITUTE FOR SPECIFICATION 156-37—Page 1—Paging 2 to 5—NO CHANGE.
- Blue Sheet, Part 44—NO CHANGE.
  - RAILROAD HIGHWAY GRADE CROSSING SIGNS—SPECIFICATION 155-39—Page 1—SUBSTITUTE FOR SPECIFICATION 155-37—Page 1—Paging 2 to 7—NO CHANGE.
- Blue Sheet, Part 45—NO CHANGE.
  - Forms of Construction Contract, Proposal, and Bond—One page—NO CHANGE.
- Blue Sheet, Part 46—NO CHANGE.
  - WEATHERPROOF COVERING FOR LINE WIRE—SPECIFICATION 163-39—Page 1—SUBSTITUTE FOR SPECIFICATION 163-35—Page 1—Paging 2 to 7—NO CHANGE.
- Blue Sheet, Part 47—NO CHANGE.
  - Protection by Signal in Emergencies—Requisite—One page—NO CHANGE.
- Blue Sheet, Part 48—NO CHANGE.
  - CIRCUIT CONTROLLER FOR DRAWBRIDGES—SPECIFICATION 130-39—Page 1—SUBSTITUTE FOR SPECIFICATION 130-38—Page 1—Paging 2 to 5—NO CHANGE.
- Blue Sheet, Part 49—NO CHANGE.
  - UNIVERSAL SWITCH CIRCUIT CONTROLLER—SPECIFICATION 95-39—Page 1—SUBSTITUTE FOR SPECIFICATION 9530—Page 1—Paging 2 to 4—NO CHANGE—Page 5—SUBSTITUTE—Paging 6 and 7—NO CHANGE.

Blue Sheet, Part 50—NO CHANGE.

ELECTRIC COLOR POSITION LIGHT SIGNAL—SPECIFICATION 162-39—Page 1—SUBSTITUTE FOR SPECIFICATION 162-35—Page 1—Paging 2 to 7—NO CHANGE.

Blue Sheet, Part 51—NO CHANGE.

Specification for Pole Line Hardware—Paging 1 and 2—NO CHANGE.

Blue Sheet, Part 52—NO CHANGE.

General Classification for Signal Interruptions—One page—NO CHANGE.

Blue Sheet, Part 53—NO CHANGE.

ALTERNATING CURRENT POWER TRANSFER RELAY—SPECIFICATION 148-39—Page 1—SUBSTITUTE FOR SPECIFICATION 148-37—Page 1—Paging 2 to 8—NO CHANGE.

Blue Sheet, Part 54—NO CHANGE.

MAINTAINING AND TESTING MOTOR SEMAPHORE SIGNALS—INSTRUCTIONS—Paging 1 to 3—SUBSTITUTE—Paging 4 to 7—NO CHANGE—Page 8—SUBSTITUTE—Paging 9 to 18—NO CHANGE.

Blue Sheet, Part 55—NO CHANGE.

Technical Terms Used in Signaling—Definitions—Sheet A—NO CHANGE—Sheets A-1 and A-2—NO CHANGE—Paging 1 to 102—NO CHANGE.

Blue Sheet, Part 56—NO CHANGE.

Derails—One page—NO CHANGE.

Blue Sheet, Part 57—NO CHANGE.

Form of Agreement for Interlocking Plant—Page 1—NO CHANGE—Agreements on Principles Applicable to Joint Signal Facilities—Paging 2 and 3—NO CHANGE—Joint Signal Facilities—Construction Cost Detail—Paging 4 and 5—NO CHANGE.

Blue Sheet, Part 58—NO CHANGE.

HARD FIBRE—SPECIFICATION 13-39—Page 1—SUBSTITUTE FOR SPECIFICATION 13-35—Page 1—Paging 2 to 5—NO CHANGE.

Blue Sheet, Part 59—NO CHANGE.

Inpsecting and Testing Automatic Interlocking—Instructions—Paging 1 and 2—NO CHANGE.

Blue Sheet, Part 60—NO CHANGE.

INSULATING MATERIAL FOR FILLING AND SEALING RECESSES IN SIGNAL APPARATUS—SPECIFICATION 177-39—Page 1—SUBSTITUTE FOR SPECIFICATION 177-37—Page 1—Page 2—NO CHANGE.

Blue Sheet, Part 61—NO CHANGE.

Maintaining and Testing Light Signals—Instructions—Paging 1 to 3—NO CHANGE.

Blue Sheet, Part 62—NO CHANGE.

FUSES—SPECIFICATION 96-39—Page 1—SUBSTITUTE FOR SPECIFICATION 9633—Page 1—Paging 2 to 4—NO CHANGE.

Blue Sheet, Part 63—NO CHANGE.

GALVANIZING FOR IRON OR STEEL—SPECIFICATION 29-39—Paging 1 to 3—SUBSTITUTE FOR SPECIFICATION 2912—Paging 1 to 3.

Blue Sheet, Part 64—NO CHANGE.

Interlocking at Drawbridges for the Protection of Train Movements—Specification 175-38—Paging 1 to 3—NO CHANGE.

Blue Sheet, Part 65—NO CHANGE.

DIRECT CURRENT GENERATOR—SPECIFICATION 14-39—Page 1—SUBSTITUTE FOR SPECIFICATION 1432—Page 1—Paging 2 to 6—NO CHANGE.

Blue Sheet, Part 66—NO CHANGE.
KEROSENE HAND LANTERN GLOBES—SPECIFICATION 59-39—Page 1—SUBSTITUTE FOR SPECIFICATION 59-38—Page 1—Paging 2 to 4—NO CHANGE—Page 5—SUBSTITUTE—Page 6—NO CHANGE—Page 7—SUBSTITUTE—Paging 8 to 11—NO CHANGE.

Blue Sheet, Part 67—NO CHANGE.
IMPEDANCE BOND—SPECIFICATION 74-39—Page 1—SUBSTITUTE FOR SPECIFICATION 7432—Page 1—Paging 2 to 5—NO CHANGE.

Blue Sheet, Part 68—NO CHANGE.
Maintaining and Operating Rectifiers—Instructions—Paging 1 to 6—NO CHANGE.

Blue Sheet, Part 69—NO CHANGE.
COPPER-COVERED STEEL GUY AND MESSENGER STRAND—SPECIFICATION 173-39—Page 1—SUBSTITUTE FOR SPECIFICATION 173-37—Page 1—Paging 2 to 6—NO CHANGE.

Blue Sheet, Part 70—NO CHANGE.
Specification for Bronze Guy and Messenger Strand—One page—NO CHANGE.

Blue Sheet, Part 71—NO CHANGE.
Take Siding Indicator and Leave Siding Indicator for Non-Interlocked Switch—Requisites—One page—NO CHANGE.

Blue Sheet, Part 72—NO CHANGE.
Switch Indicators—Requisites—Paging 1 and 2—NO CHANGE.

Blue Sheet, Part 73—NO CHANGE.
Maintaining and Handling Dry Cells—Instructions—Paging 1 to 3—NO CHANGE.

Blue Sheet, Part 74—NO CHANGE.
Guide for Allocating Train Control Expenditures—One page—NO CHANGE.

Blue Sheet, Part 75—NO CHANGE.
ELECTRIC INTERLOCKING—SPECIFICATION 65-37—Paging 1 to 9—NO CHANGE—Page 10—SUBSTITUTE—Paging 11 to 13—NO CHANGE—Page 14—SUBSTITUTE—Page 15—NO CHANGE—Page 16—SUBSTITUTE—Paging 17 to 27—NO CHANGE.

Blue Sheet, Part 76—NO CHANGE.
ELECTRO-MECHANICAL AND MECHANICAL INTERLOCKING—SPECIFICATION 66-37—Paging 1 to 9—NO CHANGE—Page 10—SUBSTITUTE—Paging 11 to 19—NO CHANGE—Page 20—SUBSTITUTE—Page 21—NO CHANGE—Page 22—SUBSTITUTE—Paging 23 to 34—NO CHANGE.

Blue Sheet, Part 77—NO CHANGE.
Spring Switch Markers—One page—NO CHANGE.

Blue Sheet, Part 78—NO CHANGE.
Grade Signal Markers—One page—NO CHANGE.

Blue Sheet, Part 79—NO CHANGE.
ELECTRO-PNEUMATIC INTERLOCKING—SPECIFICATION 6733—Paging 1 to 6—NO CHANGE—Page 7—SUBSTITUTE—Paging 8 and 9—NO CHANGE—Page 10—SUBSTITUTE—Paging 11 to 15—NO CHANGE—Paging 16 and 17—SUBSTITUTE—Paging 18 to 20—NO CHANGE—Page 21—SUBSTITUTE—Paging 22 to 26—NO CHANGE.

Blue Sheet, Part 80—NO CHANGE.
DRY PROCESS PORCELAIN INSULATION—SPECIFICATION 144-39—Page 1—SUBSTITUTE FOR SPECIFICATION 144-36—Page 1—Paging 2 and 3—NO CHANGE.

Blue Sheet, Part 81—NO CHANGE.
Minimizing the Effect of Lightning on Track Circuits—Requisites—One page—NO CHANGE.

Blue Sheet, Part 82—NO CHANGE.

MECHANICAL INTERLOCKING MACHINE, S. & F. LOCKING—SPECIFICATION 75-39—Page 1—SUBSTITUTE FOR SPECIFICATION 75-36—Page 1—Paging 2 to 7—NO CHANGE.

Blue Sheet, Part 83—NO CHANGE.

MECHANICAL INTERLOCKING MACHINE, STYLE "A" LOCKING—SPECIFICATION 114-39—Page 1—SUBSTITUTE FOR SPECIFICATION 114-36—Page 1—Paging 2 to 7—NO CHANGE.

Blue Sheet, Part 84—NO CHANGE.

WIRING—SPECIFICATION 119-39—Paging 1 to 6—SUBSTITUTE FOR SPECIFICATION 11929—Paging 1 to 6.

Blue Sheet, Part 85—NO CHANGE.

ELECTRIC INTERLOCKING MACHINE—SPECIFICATION 76-39—Page 1—SUBSTITUTE FOR SPECIFICATION 76-36—Page 1—Paging 2 to 7—NO CHANGE—Page 8—SUBSTITUTE.

Blue Sheet, Part 86—NO CHANGE.

Centralized Traffic Control System—Requisites—Paging 1 and 2—NO CHANGE.

Blue Sheet, Part 87—NO CHANGE.

Automatic Block Signal System—Requisites—One page—NO CHANGE.

Blue Sheet, Part 88—NO CHANGE.

SPECIFICATION FOR GRAY IRON CASTINGS—One page—SUBSTITUTE.

Blue Sheet, Part 89—NO CHANGE.

Specification for Malleable Iron Castings—One page—NO CHANGE.

Blue Sheet, Part 90—NO CHANGE.

SPECIFICATION FOR REFINED IRON BARS—One page—SUBSTITUTE FOR SPECIFICATION FOR WROUGHT IRON BARS—One page.

Blue Sheet, Part 91—NO CHANGE.

INCANDESCENT ELECTRIC LAMPS—SPECIFICATION 51-39—Page 1—SUBSTITUTE FOR SPECIFICATION 5115—Page 1—Paging 2 to 8—NO CHANGE.

Blue Sheet, Part 92—NO CHANGE.

INSTALLATION OF MADE GROUND FOR PROTECTION AGAINST ABNORMAL POTENTIALS—SPECIFICATION 60-39—Page 1—SUBSTITUTE FOR SPECIFICATION 6031—Page 1—Paging 2 and 3—NO CHANGE.

Blue Sheet, Part 93—NO CHANGE.

ELECTRIC COLOR LIGHT SIGNAL OPERATING MECHANISM, SEARCHLIGHT TYPE—SPECIFICATION 157-39—Page 1—SUBSTITUTE FOR SPECIFICATION 157-34—Page 1—Paging 2 to 8—NO CHANGE.

Blue Sheet, Part 94—NO CHANGE.

Interlocking System—Requisites—One page—NO CHANGE.

Blue Sheet, Part 95—NO CHANGE.

LOW-VOLTAGE LIGHTNING ARRESTER—SPECIFICATION 52-39—Page 1—SUBSTITUTE FOR SPECIFICATION 52-35—Page 1—Paging 2 to 5—NO CHANGE.

Blue Sheet, Part 96—NO CHANGE.

ELECTRIC LOCKS—SPECIFICATION 99-39—Page 1—SUBSTITUTE FOR SPECIFICATION 99-36—Page 1—Paging 2 to 8—NO CHANGE—Page 9—SUBSTITUTE.

Blue Sheet, Part 97—NO CHANGE.

CENTRALIZED TRAFFIC CONTROL SYSTEM—SPECIFICATION 149-37—Paging 1 to 9—NO CHANGE—Page 10—SUBSTITUTE—Paging 11 to 13—NO CHANGE—Page 14—SUBSTITUTE—Page 15—NO CHANGE—Page 16—SUBSTITUTE—Paging 17 to 27—NO CHANGE.

Blue Sheet, Part 98—NO CHANGE.
CENTRALIZED TRAFFIC CONTROL MACHINE—SPECIFICATION 150-39—Page 1—SUBSTITUTE FOR SPECIFICATION 150-37—Page 1—Paging 2 to 6—NO CHANGE—Page 7—SUBSTITUTE.
Blue Sheet, Part 99—NO CHANGE.
MECHANICALLY LOCKING THE LEVERS OF INTERLOCKING MACHINES—REQUISITES—Paging 1 and 2—SUBSTITUTE.
Blue Sheet, Part 100—NO CHANGE.
CAPACITOR FOR POWER FACTOR CORRECTION—SPECIFICATION 160-39—Page 1—SUBSTITUTE FOR SPECIFICATION 160-35—Page 1—Paging 2 to 5—NO CHANGE.
Blue Sheet, Part 101—NO CHANGE.
TRACTIVE ARMATURE DIRECT CURRENT NEUTRAL RELAY FOR SERIES LINE APPROACH LIGHTING—SPECIFICATION 154-39—Page 1—SUBSTITUTE FOR SPECIFICATION 154-37—Page 1—Paging 2 to 8—NO CHANGE.
Blue Sheet, Part 102—NO CHANGE.
Signal Maintenance—Instructions—Paging 1 to 5—NO CHANGE.
Blue Sheet, Part 103—NO CHANGE.
Conclusions and Findings—Paging 1 to 15—NO CHANGE.
Blue Sheet, Part 104—NO CHANGE.
ELECTRIC MOTOR SWITCH OPERATING MECHANISM—SPECIFICATION 101-39—Page 1—SUBSTITUTE FOR SPECIFICATION 101-36—Page 1—Paging 2 to 7—NO CHANGE—Page 8—SUBSTITUTE.
Blue Sheet, Part 105—NO CHANGE.
TRACTIVE ARMATURE DIRECT CURRENT NEUTRAL INTERLOCKING RELAY—SPECIFICATION 186-39—Paging 1 to 10—INSERT.
Blue Sheet, Part 106—NO CHANGE.
ZERO FAHRENHEIT LUBRICATING OIL—SPECIFICATION 102-39—Page 1—SUBSTITUTE FOR SPECIFICATION 10220—Page 1—Paging 2 to 5—NO CHANGE—Page 6—SUBSTITUTE.
Blue Sheet, Part 107—NO CHANGE.
45 DEGREES BELOW ZERO FAHRENHEIT LUBRICATING OIL—SPECIFICATION 103-39—Page 1—SUBSTITUTE FOR SPECIFICATION 10320—Page 1—Paging 2 to 5—NO CHANGE—Page 6—SUBSTITUTE—Page 7—NO CHANGE.
Blue Sheet, Part 108—NO CHANGE.
TRANSFORMER OIL—SPECIFICATION 46-39—Page 1—SUBSTITUTE FOR SPECIFICATION 4631—Page 1—Page 2—NO CHANGE.
Blue Sheet, Part 109—NO CHANGE.
Overlaps in Connection with Automatic Signal Systems—One page—NO CHANGE.
Blue Sheet, Part 110—NO CHANGE.
PAINT AND PAINTING—SPECIFICATION 120-39—Page 1—SUBSTITUTE FOR SPECIFICATION 12022—Page 1—Paging 2 to 8—NO CHANGE.
Blue Sheet, Part 111—NO CHANGE.
Petrolatum for Use in Impedance Bonds—Specification 7719—Paging 1 to 3—NO CHANGE.
Blue Sheet, Part 112—NO CHANGE.
PLUG TYPE RAIL BONDS AND TRACK CIRCUIT CONNECTORS—SPECIFICATION 151-39—Page 1—SUBSTITUTE FOR SPECIFICATION 151-38—Page 1—Paging 2 to 9—NO CHANGE.
Blue Sheet, Part 113—NO CHANGE.
Compensation of Pipe Lines for the Operation of Mechanical Units—Specification 121-27—Paging 1 and 2—NO CHANGE.

Blue Sheet, Part 114—NO CHANGE.
ONE-INCH WELDED STEEL PIPE—SPECIFICATION 122-39—Page 1—SUBSTITUTE FOR SPECIFICATION 12227—Page 1—Page 2—NO CHANGE—Page 3—SUBSTITUTE—Page 4—NO CHANGE.

Blue Sheet, Part 115—NO CHANGE.
Pipe Thread—One page—NO CHANGE.

Blue Sheet, Part 116—NO CHANGE.
ONE-INCH WELDED WROUGHT IRON PIPE—SPECIFICATION 123-39—Page 1—SUBSTITUTE FOR SPECIFICATION 123-36—Paging 2 to 4—NO CHANGE.

Blue Sheet, Part 117—NO CHANGE.
LEAD ACID STATIONARY STORAGE BATTERY—SPECIFICATION 158-39—Page 1—SUBSTITUTE FOR SPECIFICATION 158-34—Page 1—Paging 2 to 5—NO CHANGE.

Blue Sheet, Part 118—NO CHANGE.
Alternating Current Power Supply and Distribution Calculations—Paging 1 to 21—NO CHANGE.

Blue Sheet, Part 119—NO CHANGE.
BRASS AND HIGH TENSILE STRENGTH METALS AND ALLOYS FOR BINDING POSTS, MACHINE SCREWS, NUTS, WASHERS, ETC., USED IN SIGNAL APPARATUS—SPECIFICATION 159-39—Page 1—SUBSTITUTE FOR SPECIFICATION 159-35—Page 1—Paging 2 to 4—NO CHANGE.

Blue Sheet, Part 120—NO CHANGE.
Maintaining and Testing Electric Lamps—Instructions—Paging 1 to 3—NO CHANGE.

Blue Sheet, Part 121—NO CHANGE.
AIR-COOLED REACTOR FOR LINE AND TRACK CIRCUITS—SPECIFICATION 104-39—Page 1—SUBSTITUTE FOR SPECIFICATION 10432—Page 1—Paging 2 to 5—NO CHANGE.

Blue Sheet, Part 122—NO CHANGE.
ALTERNATING CURRENT RELAY—SPECIFICATION 78-39—Page 1—SUBSTITUTE FOR SPECIFICATION 78-37—Page 1—Paging 2 to 6—NO CHANGE—Page 7—SUBSTITUTE.

Blue Sheet, Part 123—NO CHANGE.
TRACTIVE ARMATURE DIRECT CURRENT NEUTRAL RELAY WITH TWO OR MORE CONTACT FINGERS—SPECIFICATION 105-39—Page 1—SUBSTITUTE FOR SPECIFICATION 105-37—Page 1—Paging 2 to 9—NO CHANGE.

Blue Sheet, Part 124—NO CHANGE.
Inspecting, Testing and Maintaining Alternating Current Relays—Instructions—Paging 1 to 17—NO CHANGE.

Blue Sheet, Part 125—NO CHANGE.
Maintaining and Testing Car Retarder Systems—Instructions—Paging 1 to 5—NO CHANGE.

Blue Sheet, Part 126—NO CHANGE.
Inspecting, Testing and Maintaining Direct Current Relays—Instructions—Paging 1 to 10—NO CHANGE.

Blue Sheet, Part 127—NO CHANGE.
Minimizing the Effect of Foreign Current on Direct Current Track Circuits—Requisites—Paging 1 and 2—NO CHANGE.

Blue Sheet, Part 128—NO CHANGE.
Setting of Time Releases Applied to Signal Apparatus—Instructions—One page—NO CHANGE.

Blue Sheet, Part 129—NO CHANGE.
MECHANICAL TIME RELEASE—SPECIFICATION 128-39—Page 1—SUBSTITUTE FOR SPECIFICATION 128-35—Page 1—Paging 2 to 6—NO CHANGE.

Blue Sheet, Part 130—NO CHANGE.
  Measurement of Insulation Resistance—Paging 1 to 6—NO CHANGE.
Blue Sheet, Part 131—NO CHANGE.
  Direct Current Track Circuit Test Record—A.R.A. Sig. Sec. 7021 and 7022—Paging 1 and 2—NO CHANGE.
Blue Sheet, Part 132—NO CHANGE.
  Formulae for Computing Minimum Allowable Resistance Between Track Battery and Track and for Computing Related Current and Voltage Data—Paging 1 to 8—NO CHANGE.
Blue Sheet, Part 133—NO CHANGE.
  Installing, Inspecting, Testing and Maintaining Insulated Rail Joints—Instructions—Paging 1 and 2—NO CHANGE.
Blue Sheet, Part 134—NO CHANGE.
  Inspecting, Testing and Maintaining Switch Circuit Controllers—Instructions—One page—NO CHANGE.
Blue Sheet, Part 135—NO CHANGE.
  RESISTOR—SPECIFICATION 106-39—Page 1—SUBSTITUTE FOR SPECIFICATION 10628—Page 1—Paging 2 to 4—NO CHANGE.
Blue Sheet, Part 136—NO CHANGE.
  SIGNAL GLASSES—SPECIFICATION 69-39—Page 1—SUBSTITUTE FOR SPECIFICATION 69-38—Page 1—Paging 2 to 4—NO CHANGE—Page 5—SUBSTITUTE—Page 6—NO CHANGE—Page 7—SUBSTITUTE—Paging 8 to 11—NO CHANGE.
Blue Sheet, Part 137—NO CHANGE.
  TRACTIVE ARMATURE DIRECT CURRENT POLARIZED RELAY —SPECIFICATION 165-39—Page 1—SUBSTITUTE FOR SPECIFICATION 165-36—Page 1—Paging 2 to 9—NO CHANGE.
Blue Sheet, Part 138—NO CHANGE.
  Maintaining and Testing Interlocking Plants—Instructions—Paging 1 to 6—NO CHANGE.
Blue Sheet, Part 139—NO CHANGE.
  COPPER-OXIDE RECTIFIERS AND VALVES—SPECIFICATION 166-39—Page 1—SUBSTITUTE FOR SPECIFICATION 166-36—Page 1—Paging 2 to 6—NO CHANGE.
Blue Sheet, Part 140—NO CHANGE.
  Maintaining, Inspecting and Testing Spring Switches—Instructions—Paging 1 and 2—NO CHANGE.
Blue Sheet, Part 141—NO CHANGE.
  WELDED TYPE RAIL HEAD BONDS AND TRACK CIRCUIT CONNECTORS—SPECIFICATION 178-39—Page 1—SUBSTITUTE FOR SPECIFICATION 178-38—Page 1—Paging 2 to 5—NO CHANGE.
Blue Sheet, Part 142—NO CHANGE.
  MECHANICALLY APPLIED RAIL HEAD TYPE BONDS AND TRACK CIRCUIT CONNECTORS—SPECIFICATION 179-39—Page 1—SUBSTITUTE FOR SPECIFICATION 179-38—Page 1—Paging 2 to 4—NO CHANGE.
Blue Sheet, Part 143—NO CHANGE.
  FLASHER RELAY—SPECIFICATION 185-39—Paging 1 to 8—INSERT.
Blue Sheet, Part 144—NO CHANGE.
  ELECTRIC MOTOR SEMAPHORE SIGNAL—SPECIFICATION 79-39—Page 1—SUBSTITUTE FOR SPECIFICATION 7933—Page 1—Paging 2 to 11—NO CHANGE—Page 12—SUBSTITUTE—Paging 13 and 14—NO CHANGE—Page 15—SUBSTITUTE.
Blue Sheet, Part 145—NO CHANGE.
  CENTRALIZED TRAFFIC CONTROL DETACHABLE TYPE NEUTRAL DIRECT CURRENT RELAY—SPECIFICATION 180-39—Paging 1 to 5—INSERT.

Blue Sheet, Part 146—NO CHANGE.
ELECTRIC COLOR LIGHT SIGNAL—SPECIFICATION 80-39—Page 1—SUBSTITUTE FOR SPECIFICATION 8029—Page 1—Paging 2 to 7—NO CHANGE.
Blue Sheet, Part 147—NO CHANGE.
ELECTRIC POSITION LIGHT SIGNAL—SPECIFICATION 81-39—Page 1—SUBSTITUTE FOR SPECIFICATION 81-34—Page 1—Paging 2 to 8—NO CHANGE.
Blue Sheet, Part 148—NO CHANGE.
Highway Grade Crossing Signals—Requisites—Paging 1 to 3—NO CHANGE.
Blue Sheet, Part 149—NO CHANGE.
HIGHWAY GRADE CROSSING SIGNALS—SPECIFICATION 176-37—Paging 1 to 3—NO CHANGE—Page 4—SUBSTITUTE—Page 5—NO CHANGE—Page 6—SUBSTITUTE—Paging 7 to 10—NO CHANGE.
Blue Sheet, Part 150—NO CHANGE.
Performance Report—Automatic Highway Grade Crossing Protection—A.A.R. Sig. Sec. 7054—One page—NO CHANGE.
Blue Sheet, Part 151—NO CHANGE.
PAINT AND PAINTING OF BRAID-COVERED AERIAL WIRES AND CABLES—SPECIFICATION 181-39—Paging 1 to 5—INSERT.
Blue Sheet, Part 152—NO CHANGE.
PAINT AND PAINTING OF BRAID-COVERED AERIAL WIRES AND CABLES—SPECIFICATION 187-39—Paging 1 to 5—INSERT.
Blue Sheet, Part 153—NO CHANGE.
SWITCHBOARD—SPECIFICATION 107-39—Page 1—SUBSTITUTE FOR SPECIFICATION 107-37—Page 1—Paging 2 to 9—NO CHANGE.
Blue Sheet, Part 154—NO CHANGE.
Installation and Operation of Switchboard—Instructions—Paging 1 to 10—NO CHANGE.
Blue Sheet, Part 155—NO CHANGE.
MULTIPLE UNIT TERMINAL BLOCK—SPECIFICATION 183-39—Paging 1 to 3—INSERT.
Blue Sheet, Part 156—NO CHANGE.
TRACK WELDING OR HEAT TREATING IN TRACK CIRCUIT TERRITORY—REQUISITES—One page—INSERT.
Blue Sheet, Part 157—NO CHANGE.
Friction Tape for Railroad Use—Specification 8226—Paging 1 to 4—NO CHANGE.
Blue Sheet, Part 158—NO CHANGE.
RUBBER INSULATING TAPE—SPECIFICATION 56-39—Page 1—SUBSTITUTE FOR SPECIFICATION 5632—Page 1—Paging 2 and 3—NO CHANGE.
Blue Sheet, Part 159—NO CHANGE.
Train Approach Signals—One page—NO CHANGE.
Blue Sheet, Part 160—NO CHANGE.
PIN TYPE PORCELAIN INSULATORS—SPECIFICATION 146-39—Page 1—SUBSTITUTE FOR SPECIFICATION 14631—Page 1—Paging 2 to 9—NO CHANGE.
Blue Sheet, Part 161—NO CHANGE.
A.C. Track Circuit Characteristics—Paging 1 to 11—NO CHANGE.
Blue Sheet, Part 162—NO CHANGE.
Maintenance and Operation of Alternating Current Track Circuits—Instructions—Paging 1 to 6—NO CHANGE.
Blue Sheet, Part 163—NO CHANGE.
STRINGING SAGS FOR NEW LINE WIRE—TABLES I to IV—Paging 1 to 4—INSERT.

Blue Sheet, Part 164—NO CHANGE.
AIR-COOLED TRANSFORMER—SPECIFICATION 83-39—Page 1—SUBSTITUTE FOR SPECIFICATION 83-35—Page 1—Paging 2 to 9—NO CHANGE.

Blue Sheet, Part 165—NO CHANGE.
TRANSFORMER, OIL-IMMERSED, SELF-COOLED—SPECIFICATION 84-39—Page 1—SUBSTITUTE FOR SPECIFICATION 84-37—Page 1—Paging 2 to 9—NO CHANGE.

Blue Sheet, Part 166—NO CHANGE.
(VACANT.)

Blue Sheet, Part 167—NO CHANGE.
TRUNKING AND CAPPING—SPECIFICATION 57-39—Page 1—SUBSTITUTE FOR SPECIFICATION 5728—Page 1—Paging 2 to 4—NO CHANGE.

Blue Sheet, Part 168—NO CHANGE.
PORTABLE DIRECT CURRENT VOLTMETERS, AMMETERS AND VOLT-AMMETERS—SPECIFICATION 85-39—Page 1—SUBSTITUTE FOR SPECIFICATION 85-36—Page 1—Paging 2 to 6—NO CHANGE.

Blue Sheet, Part 169—NO CHANGE.
PORTABLE ALTERNATING CURRENT VOLTMETER—SPECIFICATION 115-39—Page 1—SUBSTITUTE FOR SPECIFICATION 115-35—Page 1—Paging 2 to 5—NO CHANGE.

Blue Sheet, Part 170—NO CHANGE.
Voltage Ranges for Signal Work—One page—NO CHANGE.

Blue Sheet, Part 171—NO CHANGE.
Impregnating Compound Treatment of Electrical Windings—Requisites—One page—NO CHANGE.

Blue Sheet, Part 172—NO CHANGE.
WEATHER-RESISTING BRAID COVERINGS FOR AERIAL, RUBBER-INSULATED WIRE AND CABLE—SPECIFICATION 182-39—Page 1—SUBSTITUTE FOR SPECIFICATION 182-38—Page 1—Paging 2 to 5—NO CHANGE.

Blue Sheet, Part 173—NO CHANGE.
BARE COPPER ALLOY LINE WIRE, THIRTY PER CENT CONDUCTIVITY—SPECIFICATION 168-39—Page 1—SUBSTITUTE FOR SPECIFICATION 168-36—Page 1—Paging 2 and 3—NO CHANGE.

Blue Sheet, Part 174—NO CHANGE.
Varnish Treatment of Electrical Windings—Requisites—One page—NO CHANGE.

Blue Sheet, Part 175—NO CHANGE.
Copper Bond Wire—Specification 10820—Paging 1 and 2—NO CHANGE.

Blue Sheet, Part 176—NO CHANGE.
FORTY PER CENT CONDUCTIVITY COPPER-COVERED STEEL BONDING WIRE—SPECIFICATION 70-39—Page 1—SUBSTITUTE FOR SPECIFICATION 7032—Page 1—Page 2—NO CHANGE.

Blue Sheet, Part 177—NO CHANGE.
GALVANIZED E.B.B. STEEL BONDING WIRE—SPECIFICATION 22-39—Page 1—SUBSTITUTE FOR SPECIFICATION 2232—Page 1—Page 2—NO CHANGE.

Blue Sheet, Part 178—NO CHANGE.
Wire Inspection Report—One page—NO CHANGE.

Blue Sheet, Part 179—NO CHANGE.
WIRE JOINTS—SPECIFICATION 11033—Page 1—SUBSTITUTE—Page 2—NO CHANGE.

Blue Sheet, Part 180—NO CHANGE.
BARE COPPER-COVERED STEEL LINE WIRE, THIRTY PER CENT CONDUCTIVITY—SPECIFICATION 167-39—Page 1—SUBSTITUTE FOR SPECIFICATION 167-36—Page 1—Paging 2 to 4—NO CHANGE.
Blue Sheet, Part 181—NO CHANGE.
SPECIFICATION FOR GALVANIZED COPPER BEARING STEEL LINE WIRE—One page—SUBSTITUTE FOR SPECIFICATION 32-12A—Paging 1 to 3.
Blue Sheet, Part 182—NO CHANGE.
BARE HARD-DRAWN COPPER LINE WIRE—SPECIFICATION 169-39—Page 1—SUBSTITUTE FOR SPECIFICATION 169-36—Page 1—Paging 2 and 3—NO CHANGE.
Blue Sheet, Part 183—NO CHANGE.
SPECIFICATION FOR ENAMELED ROUND COPPER MAGNET WIRE—One page—SUBSTITUTE FOR SPECIFICATION 4113—Paging 1 to 4.
Blue Sheet, Part 184—NO CHANGE.
SPECIFICATION FOR STEEL GUY AND MESSENGER STRAND—One page—SUBSTITUTE FOR SPECIFICATION 4714—Paging 1 and 2.
Blue Sheet, Part 185—NO CHANGE.
Recommended Sags for Messenger Wires—Paging 1 and 2—NO CHANGE.
Blue Sheet, Part 186—NO CHANGE.
MINERAL MATTER RUBBER COMPOUND INSULATED WIRE—SPECIFICATION 111-39—Page 1—SUBSTITUTE FOR SPECIFICATION 11133—Page 1—Paging 2 to 15—NO CHANGE.
Blue Sheet, Part 187—NO CHANGE.
INSULATION RESISTANCE IN MEGOHMS PER MILE AT SIXTY DEGREES FAHRENHEIT—One page—OBSOLETE.
Blue Sheet, Part 188—NO CHANGE.
Minimizing Condensation and Frost Conditions—Requisites—Paging 1 and 2—NO CHANGE.
Blue Sheet, Part 189—NO CHANGE.
Table of Wires Required for Stranded and Flexible Conductors—One page—NO CHANGE.
Blue Sheet, Part 190—NO CHANGE.
Instructions for Handling Insulated Wires and Cables—Paging 1 to 5—NO CHANGE.
Blue Sheet, Part 191—NO CHANGE.
Railroad Specifications for Electric Light, Power Supply and Trolley Lines Crossing Railways—One page—NO CHANGE.
Blue Sheet, Part 192—NO CHANGE.
Specification for Telegraph, Telephone and Other Communication Wires and Cables Crossing the Tracks of Steam and Electrified Railroads——One page—NO CHANGE.
Blue Sheet, Part 193—NO CHANGE.
ELECTRO-MECHANICAL INTERLOCKING MACHINE—SPECIFICATION 134-39—Page 1—SUBSTITUTE FOR SPECIFICATION 134-38—Page 1—Paging 2 to 7—NO CHANGE—Page 8—SUBSTITUTE.
Blue Sheet, Part 194—NO CHANGE.
Signal Layout for Remote Switches—One page—NO CHANGE.
Blue Sheet, Part 195—NO CHANGE.
Switch Circuit Controller Shunting Circuit Resistance Test—A.R.A. Sig. Sec. 7002—One page—NO CHANGE.
Blue Sheet, Part 196—NO CHANGE.
Train Shunt Resistance Test—A.R.A. Sig. Sec. 7003—One page—NO CHANGE.

Blue Sheet, Part 197—NO CHANGE.
INTERLOCKING LEVER CIRCUIT CONTROLLER—SPECIFICATION 138-39—Page 1—SUBSTITUTE FOR SPECIFICATION 138-35—Page 1—Paging 2 to 6—NO CHANGE.
Blue Sheet, Part 198—NO CHANGE.
Factors Which Govern in Determining the Type of Interlocking Which Should be Installed—Paging 1 and 2—NO CHANGE.
Blue Sheet, Part 199—NO CHANGE.
Testing Electric Locking—Instructions—Paging 1 to 3—NO CHANGE.
Blue Sheet, Part 200—NO CHANGE.
INSPECTING AND TESTING MECHANICAL LOCKING OF AN INTERLOCKING MACHINE—INSTRUCTIONS—Paging 1 to 3—SUBSTITUTE.
Blue Sheet, Part 201—NO CHANGE.
(VACANT).
Blue Sheet, Part 202—NO CHANGE.
PRESERVATIVE TREATMENT OF CAPPING AND GROOVED TRUNKING—SPECIFICATION 140-39—Page 1—SUBSTITUTE FOR SPECIFICATION 14026—Page 1—Paging 2 to 4—NO CHANGE.
Blue Sheet, Part 203—NO CHANGE.
Example of Use of Unit Value Basis—Paging 1 to 5—NO CHANGE—Table of Signal and Interlocking Units—Paging 6 to 8—NO CHANGE—A.A.R. Sig. Sec. 7050—Page 9—NO CHANGE.
Blue Sheet, Part 204—NO CHANGE.
OIL LIGHTED LAMP—SPECIFICATION 137-39—Page 1—SUBSTITUTE FOR SPECIFICATION 13726—Page 1—Paging 2 and 3—NO CHANGE.
Blue Sheet, Part 205—NO CHANGE.
(VACANT.)
Blue Sheet, Part 206—NO CHANGE.
Fouling Protection—Turnouts and Crossovers—A.R.A. Sig. Sec. 7004—One page—NO CHANGE.
Blue Sheet, Part 207—NO CHANGE.
(VACANT).
Blue Sheet, Part 208—NO CHANGE.
AUTOMATIC INTERLOCKING—SPECIFICATION 141-34—Paging 1 to 11—NO CHANGE—Page 12—SUBSTITUTE—Paging 13 to 20—NO CHANGE.

DRAWINGS

TITLE PAGE—One page—SUBSTITUTE.
NUMERICAL LIST—Paging 1 to 10—SUBSTITUTE.
INDEX—ALPHABETICAL—Paging 1 to 30—SUBSTITUTE.
DRAWINGS AS FOLLOWS:
1002, 1007, 1008B, 1010E, 1011C, 1013B, 1014C, 1015A, 1016B, 1017B, 1018, 1019B, 1021, 1022B, 1023B, 1035B, 1036B, 1040B, 1041B, 1043D, 1044D, 1046A, 1047A and 1048A—Twenty-four sheets—NO CHANGE.
1049A—One sheet—SUBSTITUTE.
1052 and 1053B—Two sheets—NO CHANGE.
1054A—One sheet—INSERT.
1055C, 1056C, 1057C, 1058B, 1059A, 1060, 1061C, 1062, 1063, 1064, 1065B, 1066B, 1067, 1069A, 1070E, 1072B, 1073, 1074B, 1075B, 1080, 1081A, 1082, 1083, 1084B, 1085B, 1086B, 1090, 1091, 1092, 1093, 1094C, 1095C and 1097—Thirty-three sheets—NO CHANGE.
1100B and 1101B—Two sheets—SUBSTITUTE.
1103A and 1104—Two sheets—NO CHANGE.

1107C—One sheet—SUBSTITUTE FOR 1107B.
1156 and 1175—Two sheets—NO CHANGE.
1176 and 1177—Two sheets—SUBSTITUTE.
1178B, 1192A and 1193A—Three sheets—NO CHANGE.
1194—One sheet—SUBSTITUTE.
1195, 1197, 1200, 1201, 1202, 1203, 1204, 1205B, 1206, 1207, 1217, 1225B, 1232, 1233, 1236C, 1238A, 1239, 1245A, 1250A, 1251A, 1254A, 1255C, 1256A and 1259B—Twenty-four sheets—NO CHANGE.
1266B, 1267B, 1268B and 1269B—Four sheets—SUBSTITUTE FOR 1266A, 1267A, 1268A and 1269A.
1331—One sheet—NO CHANGE.
1332—One sheet—SUBSTITUTE.
1333—One sheet—NO CHANGE.
1334—One sheet—SUBSTITUTE.
1335, 1336, 1337, 1338, 1339, 1355, 1356, 1357B, 1360, 1362B, 1363, 1364B, 1365B, 1366B, 1371B, 1373C, 1375B, 1376, 1377B, 1380A, 1387, 1390C, 1391C, 1392C, 1393B, 1396A, 1397, 1398A, 1399B, 1403, 1404, 1405, 1406B, 1407, 1408, 1409, 1411, 1412A and 1414—Thirty-nine sheets—NO CHANGE.
1418A—One sheet—INSERT.
1419B—One sheet—SUBSTITUTE.
1422A, 1424B, 1425C, 1426C, 1427B, 1428 and 1429—Seven sheets—NO CHANGE.
1430B and 1440B—Two sheets—SUBSTITUTE.
1441, 1442B, 1443B and 1445C—Four sheets—NO CHANGE.
1446A and 1449B—Two sheets—SUBSTITUTE FOR 1446A and 1449.
1454B, 1456, 1457B, 1458C and 1459—Five sheets—NO CHANGE.
1460B—One sheet—SUBSTITUTE.
1461B—One sheet—NO CHANGE.
1470B and 1480B—Two sheets—SUBSTITUTE.
1496, 1497B, 1498, 1499B, 1500, 1501, 1502, 1503 and 1504B—Nine sheets—NO CHANGE.
1531, 1532 and 1533—Three sheets—OBSOLETE.
1534, 1535, 1536, 1537, 1538, 1544B, 1545B, 1548, 1550A, 1551, 1552B, 1553, 1556, 1557A, 1558A, 1563B, 1564B, 1565A, 1566A, 1567A, 1568A, 1583B, 1585B, 1586A, 1587A, 1592A, 1593A, 1594A, 1595A, 1596A, 1599A and 1600A—Thirty-two sheets—NO CHANGE.
1610A—One sheet—OBSOLETE.
1611D—One sheet—SUBSTITUTE FOR 1611C.
1612A, 1613A, 1614A, 1615A, 1616A, 1617A, 1618A, 1619A, 1620A, 1621A, 1622A, 1623A, 1624A, 1626B, 1627B, 1628B, 1629A, 1630A, 1631C, 1632C, 1633B, 1634B, 1635B, 1636B, 1637B, 1638A, 1639A, 1640B, 1641B, 1642B, 1643B, 1644B, 1645B, 1646B, 1647C, 1648B, 1649A, 1650B, 1651B, 1652B, 1653B, 1654B, 1655B, 1656B, 1657B, 1660A, 1661A, 1662A, 1663A, 1664A, 1665A, 1666A, 1667A, 1668A, 1669A, 1673A, 1674A, 1675A, 1676A, 1677A, 1678A, 1679A, 1680A, 1681A and 1686A—Sixty-five sheets—NO CHANGE.
1691A, 1692A, 1693A, 1694A and 1695A—Five sheets—INSERT.

ASSOCIATION OF AMERICAN RAILROADS
OPERATIONS AND MAINTENANCE DEPARTMENT

ENGINEERING DIVISION

SIGNAL SECTION

Manual of Recommended Practice

SPECIFICATIONS, ETC.

COMPLETE TO 1939 ANNUAL MEETING

Published by the Association
30 Vesey St., New York, N. Y.

PRINTED IN U. S. A.

SPECIFICATIONS, ETC.

INDEX

1939

Part
Abnormal Potentials; Installation of Made Ground for Protection Against—Specification 60 (60-39) 92
Aerial Aluminum Cable Steel Reinforced—Specification 54 (54-39) 24
Aerial Braided Cable—Specification 89 (89-39) 25
Aerial, Rubber-Insulated Wire and Cable; Weather-Resisting Braid Coverings for—Specification 182 (182-39) 172
Aerial Wires and Cables, Braid-Covered; Paint and Painting of:
  Cable Paint—Asphalt or Coal Tar Emulsion—Specification 187 (187-39) 152
  Cable Paint—Volatile Thinner—Specification 181 (181-39) 151
Agreement for Interlocking Plant, Form of 57
Agreements on Principles Applicable to Joint Signal Facilities 57
Air-Cooled Reactor for Line and Track Circuits—Specification 104 (104-39) 121
Air-Cooled Transformer—Specification 83 (83-39) 164
Air Depolarized Dry Cell—Specification 170 (170-39) 11
Alkaline Storage Batteries, Nickel, Iron; Installation, Maintenance and Operation—Instructions 16
Alkaline Storage Battery; Nickel, Iron—Specification 49 (49-39) 15
Allocating Train Control Expenditures, Guide for 74
Alloy, Bare Copper, Line Wire, Thirty Per Cent Conductivity—Specification 168 (168-39) 173
Alloy Type Lead Acid Stationary Storage Battery—Specification 158 (158-39) 117
Alloys, High Tensile Strength Metals and, for Binding Posts, Machine Screws, Nuts, Washers, etc., Used in Signal Apparatus—Specification 159 (159-39) 119
Alternating Current:
  Ammeter, Portable—Specification 112 (112-39) 3
  Electrical Apparatus:
    Daily Field Test Record:
      Alternating Current—A.A.R. Sig. Sec. 7052 124
      Direct Current—A.A.R. Sig. Sec. 7016 126
    Office Test Record:
      Alternating Current—A.A.R. Sig. Sec. 7051 124
      Direct Current—A.A.R. Sig. Sec. 7015 126
  Generator—Specification 73 (73-39) 2
  Power Supply and Distribution Calculations 118
  Power Transfer Relay—Specification 148 (148-39) 53
  Relay—Specification 78 (78-39) 122
  Relay Record Tag—A.A.R. Sig. Sec. 7053 124
  Relays; Inspecting, Testing and Maintaining—Instructions 124
  Relays, Operating Characteristics—Table I 124
  Track Circuit Characteristics 161
  Track Circuits, Maintenance and Operation of—Instructions 162
  Voltmeter, Portable—Specification 115 (115-39) 169

PRINTED IN U. S. A.

Part

Aluminum Cable, Aerial; Steel Reinforced—Specification 54 (54-39) 24
Ammeter, Portable Alternating Current—Specification 112 (112-39) 3
Ammeters, Portable Direct Current—Specification 85 (85-39) 168
Apparatus, Electrical:
  Daily Field Test Record:
    Alternating Current—A.A.R. Sig. Sec. 7052 124
    Direct Current—A.A.R. Sig. Sec. 7016 126
  Office Test Record:
    Alternating Current—A.A.R. Sig. Sec. 7051 124
    Direct Current—A.A.R. Sig. Sec. 7015 126
Apparatus, Signal; Minimizing Condensation and Frost Conditions—Requisites 188
Application of Signals 1
Application of Symbols and Wire Nomenclature; Example of 33
Approach Lighting, Series Line; Tractive Armature Direct Current Neutral Relay for—Specification 154 (154-39) 101
Approach Signals, Train 159
Armature, Tractive; Direct Current Neutral Relay:
  Centralized Traffic Control Detachable Type—Specification 180 (180-39) 145
  For Series Line Approach Lighting—Specification 154 (154-39) 101
  Interlocking—Specification 186 (186-39) 105
  With Two or More Contact Fingers—Specification 105 (105-39) 123
Armature, Tractive; Direct Current Polarized Relay—Specification 165 (165-39) 137
Armored Submarine Cable—Specification 90 (90-39) 26
Arrester, Lightning, Low-Voltage—Specification 52 (52-39) 95
Aspects and Indications, Cab Signal 1
Aspects and Indications for Continuous Automatic Cab Signals 1
Asphalt or Coal Tar Emulsion Cable Paint—Paint and Painting of Braid-Covered Aerial Wires and Cables—Specification 187 (187-39) 152
Automatic Block Signal System:
  Requisites 87
  Specification 63 (63-36) 5
Automatic Block Signaling Circuits—Requisites 34
Automatic Block Signals—Conclusion and Findings 103
Automatic Cab Signals, Continuous; Aspects and Indications for 1
Automatic Gates—Highway Crossings at Grade over Railway Tracks—Requisites 35
Automatic Highway Grade Crossing Protection—Performance Report—A.A.R. Sig. Sec. 7054 150
Automatic Interlocking:
  Conclusion and Findings 103
  Inspecting and Testing—Instructions 59
  Specification 141 (141-34) 208
Automatic Signal Systems, Overlaps in Connection with 109
Bare Copper Alloy Line Wire, Thirty Per Cent Conductivity—Specification 168 (168-39) 173
Bare Copper-Covered Steel Line Wire, Thirty Per Cent Conductivity—Specification 167 (167-39) 180
Bare Hard-Drawn Copper Line Wire—Specification 169 (169-39) 182
Bars, Refined Iron; Specification for 90
Bars, Wrought Iron; Specification for 90
Basis, Unit Value; Example of Use of 203
Battery, Current Discharge from, with the Selected Train Shunt Resistance RS; Formula for Computing the 132

Part

Battery, Floating, Record Card—A.A.R. Sig. Sec. 7057 14
Battery Jar, Primary—Specification 113 (113-39) 9
Battery, Primary:
  Cells, Caustic Soda, Copper-Oxide:
    Installation and Maintenance of—Instructions 7
    Type "A"—Specification 87 (87-39) 6
    Type "B"—Specification 171 (171-39) 4
  Jar—Specification 113 (113-39) 9
  Record—A.A.R. Sig. Sec. 7007 7
Battery, Storage:
  Lead Acid Stationary:
    Plates of Alloy Composition Supporting Active Material in Paste Form—Specification 158 (158-39) 117
    Plates of Composite Structure Supporting Active Material in the Form of Pure Lead—Specification 53 (53-39) 18
    Plates of Pure Lead, Electro-Chemically Formed, in Combination with Plates of Alloy Supporting Active Material in Paste Form—Specification 58 (58-39) 19
  Lead Acid Type, Electrolyte; Specification for 13
  Lead Acid Type; Installation, Maintenance and Operation—Instructions 14
  Lead Acid Type Report—A.A.R. Sig. Sec. 7056 14
  Nickel, Iron, Alkaline—Specification 49 (49-39) 15
  Nickel, Iron, Alkaline; Installation, Maintenance and Operation of—Instructions 16
Battery Terminal Voltages, Various Maximum; Curves for Determining Minimum Allowable Resistance in Series with Track Battery for Various Train Shunt Resistances and, for Standard or Conventional Track Circuits 132
Battery, Track:
  And Track; Formulae for Computing Minimum Allowable Resistance between, and for Computing Related Current and Voltage Data 132
  Curves for Determining the Minimum Allowable Resistance in Series with, for Various Train Shunt Resistances and Various Terminal Battery Voltages, for Standard or Conventional Track Circuits 132
  Tables of Minimum Allowable Resistance in Series with, for Standard or Conventional Direct Current Track Circuits 132
Battery Voltage EB when the Train Shunt Resistance and the Minimum Allowable Resistance in Series with Battery has been Selected; Formula for Computing the Maximum 132
Bell, Highway Crossing; Direct Current Vibrating—Specification 44 (44-39) 21
Below Zero Fahrenheit Lubricating Oil, 45 Degrees—Specification 103 (103-39) 107
Binding Posts, Brass and High Tensile Strength Metals and Alloys for—Specification 159 (159-39) 119
Block Signal System, Automatic:
  Requisites 87
  Specification 63 (63-36) 5
Block Signaling Circuits, Automatic—Requisites 34
Block Signals, Automatic—Conclusion and Findings 103
Block, Terminal, Multiple Unit—Specification 183 (183-39) 155
Bolts, Nuts and Threads; Specification for 17
Bond; Forms of Construction Contract, Proposal and 45
Bond, Impedance—Specification 74 (74-39) 67
Bond Wire, Copper—Specification 108 (10820) 175
Bonding, Rail; Track Circuit—Specification 135 (135-39) 22

Part
Bonding Wire, Steel:
  Copper-Covered, Forty Per Cent Conductivity—Specification 70 (70-39) 176
  Galvanized E.B.B.—Specification 22 (22-39) 177
Bonds, Impedance; Petrolatum for Use in—Specification 77 (7719) 111
Bonds, Rail Head, and Track Circuit Connectors:
  Mechanically Applied Type—Specification 179 (179-39) 142
  Welded Type—Specification 178 (178-39) 141
Bonds, Rail, Plug Type, and Track Circuit Connectors:
  Resistances of Single and Duplex Conductor—A.A.R. Sig. Sec. 7058 112
  Specification 151 (151-39) 112
Braid-Covered Aerial Wires and Cables, Paint and Painting of:
  Cable Paint—Asphalt or Coal Tar Emulsion—Specification 187 (187-39) 152
  Cable Paint—Volatile Thinner—Specification 181 (181-39) 151
Braid Coverings, Weather-Resisting, for Aerial, Rubber-Insulated Wire and Cable—Specification 182 (182-39) 172
Braided Cable, Aerial—Specification 89 (89-39) 25
Brass and High Tensile Strength Metals and Alloys for Binding Posts, Machine Screws, Nuts, Washers, etc., Used in Signal Apparatus—Specification 159 (159-39) 119
Bridges, Movable; Requirements for the Protection of Traffic at 23
Bronze Guy and Messenger Strand, Specification for 70
Bulb Performance, Record of—A.A.R. Sig. Sec. 7055 120
Cab Signal Aspects and Indications 1
Cab Signals, Continuous Automatic; Aspects and Indications for 1
Cable:
  Aerial Aluminum Steel Reinforced—Specification 54 (54-39) 24
  Aerial Braided—Specification 89 (89-39) 25
  Aerial, Rubber-Insulated Wire and; Weather-Resisting Braid Coverings for—Specification 182 (182-39) 172
  Armored Submarine—Specification 90 (90-39) 26
  Lead-Covered—Specification 91 (91-39) 28
  Paint and Painting of Braid-Covered Aerial Wires and Cables:
    Asphalt or Coal Tar Emulsion—Specification 187 (187-39) 152
    Volatile Thinner—Specification 181 (181-39) 151
  Parkway—Specification 145 (145-39) 20
  Sheath, Fibrous-Covered Non-Metallic—Specification 161 (161-39) 36
Cables, Aerial Wires and, Braid-Covered; Paint and Painting of:
  Cable Paint—Asphalt or Coal Tar Emulsion—Specification 187 (187-39) 152
  Cable Paint—Volatile Thinner—Specification 181 (181-39) 151
Cables, Wires and, Insulated; Instructions for Handling 190
Calculations, Power Supply and Distribution; Alternating Current 118
Capacitor for Power Factor Correction—Specification 160 (160-39) 100
Capacity Test; Nickel, Iron, Alkaline Storage Battery—A.A.R. Sig. Sec. 7001 16
Capping and Grooved Trunking; Preservative Treatment of—Specification 140 (140-39) 202
Capping, Wood Trunking and—Specification 57 (57-39) 167
Car Retarder System—Specification 147 (147-35) 27
Car Retarder Systems, Maintaining and Testing—Instructions 125
Car Retarders—Conclusion and Findings 103
Card, Record; Floating Battery—A.A.R. Sig. Sec. 7057 14
Case, Electric Lamp—Specification 174 (174-39) 12
Castings:
  Gray Iron, Specification for 88
  Malleable Iron, Specification for 89

Part

- Caustic Soda Primary Cells, Copper-Oxide:
  - Installation and Maintenance—Instructions 7
  - Type "A"—Specification 87 (87-39) 6
  - Type "B"—Specification 171 (171-39) 4
- Cell, Dry; Air Depolarized—Specification 170 (170-39) 11
- Cell, Dry, No. 6; Specification for 31
- Cells:
  - Dry, Maintaining and Handling—Instructions 73
  - Primary, Copper-Oxide Caustic Soda:
    - Installation and Maintenance—Instructions 7
    - Type "A"—Specification 87 (87-39) 6
    - Type "B"—Specification 171 (171-39) 4
- Centralized Traffic Control:
  - Conclusion and Findings 103
  - Machine—Specification 150 (150-39) 98
  - Relay, Detachable Type Neutral Direct Current—Specification 180 (180-39) 145
  - System:
    - Requisites 86
    - Specification 149 (149-37) 97
- Channel Pins—Specification 23 (23-39) 32
- Characteristics:
  - A.C. Track Circuit 161
  - Operating—Tables:
    - Model 2-A Signals 54
    - Relays:
      - Alternating Current 124
      - Direct Current 126
    - Searchlight, Color Light Signals 61
    - Style L Signals 54
    - Styles S and B Signals 54
    - T-2 Signals 54
- Circuit Connectors, Track and Plug Type Rail Bonds:
  - Resistances of Single and Duplex Conductor—A.A.R Sig. Sec. 7058 112
  - Specification 151 (151-39) 112
- Circuit Connectors, Track; Rail Head Bonds and:
  - Mechanically Applied Type—Specification 179 (179-39) 142
  - Welded Type—Specification 178 (178-39) 141
- Circuit Controller:
  - For Drawbridges—Specification 130 (130-39) 48
  - Interlocking Lever—Specification 138 (138-39) 197
  - Switch; Inspecting, Testing and Maintaining—Instructions 134
  - Switch, Shunting Circuit Resistance Test—A.R.A. Sig. Sec. 7002 195
  - Universal Switch—Specification 95 (95-39) 49
- Circuit Nomenclature and Written Circuits 33
- Circuit Resistance Test, Switch Circuit Controller Shunting—A.R.A. Sig. Sec. 7002 195
- Circuits:
  - Automatic Block Signaling—Requisites 34
  - Line and Track; Air-Cooled Reactor for—Specification 104 (104-39) 121
  - Track:
    - Alternating Current, Maintenance and Operation of—Instructions 162
    - Characteristics, A.C. 161
    - Direct Current:
      - Curves for Determining the Minimum Allowable Resistance in Series with Track Battery for Various Train Shunt Resistances and Various Maximum Battery Terminal Voltages, for Standard or Conventional Track Circuits 132

Part

Circuits—Continued:
  Track—Continued:
    Direct Current—Continued:
      Formula for Computing Minimum Allowable Resistance between Track Battery and Track ... 132
      Formula for Computing the Current Discharge from Battery with the Selected Train Shunt Resistance RS ... 132
      Formula for Computing the Maximum Battery Voltage EB when the Train Shunt Resistance and the Minimum Allowable Resistance in Series with Battery has been Selected ... 132
      Maintenance and Operation—Instructions ... 8
      Minimizing the Effect of Foreign Current on—Requisites ... 127
      Table I—Maximum Voltage at Battery Terminals for use with 2-Ohm Relay ... 132
      Table II—Maximum Voltage at Battery Terminals for use with 4-Ohm Relay ... 132
      Tables of Minimum Allowable Resistance in Series with Track Battery for Standard or Conventional ... 132
      Test Record—A.R.A. Sig. Sec. 7021 and 7022 ... 131
    Minimizing the Effect of Lightning on—Requisites ... 81
    Rail Bonding—Specification 135 (135-39) ... 22
  Written, Circuit Nomenclature and ... 33
Classification, General, for Signal Interruptions ... 52
Classification Yards, Gravity; Signaling for ... 42
Clay Conduit, Vitrified; Specification for ... 41
Coal Tar or Asphalt Emulsion Cable Paint—Paint and Painting of Braid-Covered Aerial Wires and Cables—Specification 187 (187-39) ... 152
Color Light Signal, Electric—Specification 80 (80-39) ... 146
Color Light Signal Operating Mechanism, Electric; Searchlight Type—Specification 157 (157-39) ... 93
Color Light Signals, Searchlight; Operating Characteristics of—Table ... 61
Color Position Light Signal, Electric—Specification 162 (162-39) ... 50
Communication Underground Conduit Construction, Specification for ... 38
Compensation of Pipe Lines for the Operation of Mechanical Units—Specification 121 (121-27) ... 113
Composite Plate Type Stationary Storage Battery—Specification 53 (53-39) ... 18
Computing Minimum Allowable Resistance between Track Battery and Track and for Computing Related Current and Voltage Data; Formulae for ... 132
Computing the Current Discharge from Battery with the Selected Train Shunt Resistance RS; Formula for ... 132
Computing the Maximum Battery Voltage EB when the Train Shunt Resistance and the Minimum Allowable Resistance in Series with Battery has been Selected, Formula for ... 132
Conclusions and Findings:
  Automatic Block Signals ... 103
  Automatic Interlockings ... 103
  Car Retarders ... 103
  Centralized Traffic Control ... 103
  Consolidation of Interlockings ... 103
  Economical Train Performance on Single Track ... 103
  Electric Lighting of Signal and Switch Lamps ... 103
  Grade or Tonnage Signals ... 103
  Highway Grade Crossing Protection ... 103
  Manually-Operated Interlockings ... 103
  Remote Control ... 103
  Signal Protection for Light Traffic Railroads Crossing at Grade ... 103
  Spring Switches ... 103
  Train Operation by Signal Indication ... 103

Part
Condensation and Frost Conditions, Minimizing—Requisites 188
Conductor, Single and Duplex, Plug Type Rail Bonds and Track Circuit Connectors, Resistances of—A.A.R. Sig. Sec. 7058 112
Conductors, Stranded and Flexible; Table of Wires Required for 189
Conduit:
  Construction, Communication Underground; Specification for 38
  Fibre, Specification for 37
  Pipe, Steel—Specification 36 (3613) 39
  Pipe, Wrought Iron—Specification 37 (3713) 40
  Vitrified Clay, Specification for 41
Connectors, Track Circuit; Plug Type Rail Bonds and:
  Resistances of Single and Duplex Conductor—A.A.R. Sig. Sec. 7058 112
  Specification 151 (151-39) 112
Connectors, Track Circuit; Rail Head Bonds and:
  Mechanically Applied Type—Specification 179 (179-39) 142
  Welded Type—Specification 178 (178-39) 141
Consolidation of Interlockings—Conclusion and Findings 103
Construction, Communication Underground Conduit; Specification for 38
Construction Contract, Proposal, and Bond; Forms of 45
Construction Cost Detail—Joint Signal Facilities 57
Continuous Automatic Cab Signals, Aspects and Indications for 1
Contract, Construction, Proposal, and Bond; Forms of 45
Control:
  Centralized Traffic:
    Conclusion and Findings 103
    Machine—Specification 150 (150-39) 98
    Relay, Detachable Type Neutral Direct Current—Specification 180 (180-39) 145
    System:
      Requisites 86
      Specification 149 (149-37) 97
  Remote—Conclusion and Findings 103
  Train, Expenditures; Guide for Allocating 74
Controller, Circuit:
  For Drawbridges—Specification 130 (130-39) 48
  Interlocking Lever—Specification 138 (138-39) 197
  Switch; Inspecting, Testing and Maintaining—Instructions 134
  Switch; Shunting Circuit Resistance Test—A.R.A. Sig. Sec. 7002 195
  Switch; Universal—Specification 95 (95-39) 49
Copper Alloy Line Wire, Bare, Thirty Per Cent Conductivity—Specification 168 (168-39) 173
Copper Bearing Steel Line Wire, Galvanized; Specification for 181
Copper Bond Wire—Specification 108 (10820) 175
Copper-Covered Steel Bonding Wire, Forty Per Cent Conductivity—Specification 70 (70-39) 176
Copper-Covered Steel Guy and Messenger Strand—Specification 173 (173-39) 69
Copper-Covered Steel Line Wire, Bare, Thirty Per Cent Conductivity—Specification 167 (167-39) 180
Copper Line Wire, Bare Hard-Drawn—Specification 169 (169-39) 182
Copper Magnet Wire, Round, Enameled; Specification for 183
Copper-Oxide Caustic Soda Primary Cells:
  Installation and Maintenance—Instructions 7
  Type "A"—Specification 87 (87-39) 6
  Type "B"—Specification 171 (171-39) 4
Copper-Oxide Rectifiers and Valves—Specification 166 (166-39) 139
Correction, Power Factor; Capacitor for—Specification 160 (160-39) 100
Cost Detail, Construction—Joint Signal Facilities 57

Part
Covering, Weatherproof, for Line Wire—Specification 163 (163-39) 46
Coverings, Braid, Weather-Resisting; for Aerial, Rubber-Insulated Wire and Cable—Specification 182 (182-39) 172
Crossing Bell, Highway; Direct Current Vibrating—Specification 44 (44-39) 21
Crossing Gate, Highway Grade—Requisites 35
Crossing of Telegraph, Telephone and other Communication Wires and Cables Over Tracks of Steam and Electrified Railroads; Specification for 192
Crossing Protection, Highway Grade—Conclusion and Findings 103
Crossing Protection, Highway Grade; Automatic—Performance Report—A.A.R. Sig. Sec. 7054 150
Crossing Signals, Highway Grade:
  Requisites 148
  Specification 176 (176-37) 149
Crossing Signs, Railroad Highway Grade—Specification 155 (155-39) 44
Crossovers; Turnouts and—Fouling Protection—A.R.A. Sig. Sec. 7004 206
Current Discharge from Battery with the Selected Train Shunt Resistance RS, Formulae for Computing the 132
Current, Related, and Voltage Data, Computing; Formulae for Computing Minimum Allowable Resistance between Track Battery and Track, and for 132
Curves for Determining the Minimum Allowable Resistance in Series with Track Battery for Various Train Shunt Resistances and Various Maximum Battery Terminal Voltages, for Standard or Conventional Track Circuits 132
Cylindrical Dry Cell, No. 6; Specification for 31
Daily Field Test Record of Electrical Apparatus:
  Alternating Current—A.A.R. Sig. Sec. 7052 124
  Direct Current—A.A.R. Sig. Sec. 7016 126
Definitions for Technical Terms Used in Signaling 55
Derails 56
Detachable Type Neutral Direct Current Relay, Centralized Traffic Control—Specification 180 (180-39) 145
Determining the Minimum Allowable Resistance in Series with Track Battery for Various Train Shunt Resistances and Various Maximum Battery Terminal Voltages, for Standard or Conventional Track Circuits; Curves for 132
Determining the Type of Interlocking which Should be Installed, Factors which Govern in 198
Diagram, Load; for Calculating Power Supply and Distribution—A.C. Signal System 118
Direct Current:
  Electrical Apparatus:
    Daily Field Test Record—A.A.R. Sig. Sec. 7016 126
    Office Test Record—A.A.R. Sig. Sec. 7015 126
  Generator—Specification 14 (14-39) 65
  Neutral Relay, Tractive Armature:
    Centralized Traffic Control Detachable Type—Specification 180 (180-39) 145
    For Series Line Approach Lighting—Specification 154 (154-39) 101
    Interlocking—Specification 186 (186-39) 105
    With Two or More Contact Fingers—Specification 105 (105-39) 123
  Polarized Relay, Tractive Armature—Specification 165 (165-39) 137
  Relay Record Tag—A.A.R. Sig. Sec. 7017 126
  Relays, Inspecting, Testing and Maintaining—Instructions 126
  Relays, Operating Characteristics of—Table I 126

Part

Direct Current—Continued:
  Track Circuits:
    Curves for Determining the Minimum Allowable Resistance in Series with Track Battery for Various Train Shunt Resistances and Various Maximum Battery Terminal Voltages, for Standard or Conventional Track Circuits 132
    Formula for Computing Minimum Allowable Resistance between Track Battery and Track 132
    Formula for Computing the Current Discharge from Battery with the Selected Train Shunt Resistance RS 132
    Formula for Computing the Maximum Battery Voltage EB when the Train Shunt Resistance and the Minimum Allowable Resistance in Series with Battery has been Selected 132
    Maintenance and Operation—Instructions 8
    Minimizing the Effect of Foreign Current on—Requisites 127
    Table I—Maximum Voltage at Battery Terminals for use with 2-Ohm Relay 132
    Table II—Maximum Voltage at Battery Terminals for use with 4-Ohm Relay 132
    Tables of Minimum Allowable Resistance in Series with Track Battery for Standard or Conventional Direct Current Track Circuits 132
    Test Record 131
  Vibrating Highway Crossing Bell—Specification 44 (44-39) 21
  Voltmeters, Ammeters and Volt-Ammeters; Portable—Specification 85 (85-39) 168
Discharge, Current, from Battery with the Selected Train Shunt Resistance RS; Formula for Computing the 132
Distribution Calculations, Power Supply and; Alternating Current 118
Distribution, Signal and Interlocking Unit—A.A.R. Sig. Sec. 7050 203
Drawbridges, Circuit Controller for—Specification 130 (130-39) 48
Drawbridges, Interlocking at, for the Protection of Train Movements—Specification 175 (175-38) 64
Drawings.—See Drawing Section.
Dry Cell, Air Depolarized—Specification 170 (170-39) 11
Dry Cell, No. 6; Specification for 31
Dry Cells, Maintaining and Handling—Instructions 73
Dry Process Porcelain Insulation—Specification 144 (144-39) 80
Duplex Conductor Plug Type Rail Bonds and Track Circuit Connectors, Resistances of Single and—A.A.R. Sig. Sec. 7058 112
E.B.B. Steel Bonding Wire, Galvanized—Specification 22 (22-39) 177
Economical Train Performance on Single Track—Conclusion 103
Effect of Foreign Current on Direct Current Track Circuits, Minimizing the—Requisites 127
Effect of Lightning on Track Circuits, Minimizing the—Requisites 81
Electric Color Light Signal—Specification 80 (80-39) 146
Electric Color Light Signal Operating Mechanism, Searchlight Type—Specification 157 (157-39) 93
Electric Color Position Light Signal—Specification 162 (162-39) 50
Electric Interlocking—Specification 65 (65-37) 75
Electric Interlocking Machine—Specification 76 (76-39) 85
Electric Lamp Case—Specification 174 (174-39) 12
Electric Lamps, Incandescent—Specification 51 (51-39) 91
Electric Lamps, Maintaining and Testing—Instructions 120
Electric Light, Power Supply and Trolley Lines Crossing Railways; Railroad Specifications for 191
Electric Lighting of Signal and Switch Lamps—Conclusion and Findings 103

Part

Electric Locks—Specification 99 (99-39) 96
Electric Locking, Testing—Instructions 199
Electric Motor Semaphore Signal—Specification 79 (79-39) 144
Electric Motor Switch Operating Mechanism—Specification 101 (101-39) 104
Electric Position Light Signal—Specification 81 (81-39) 147
Electrical Apparatus, A.C.:
  Daily Field Test Record—A.A.R. Sig. Sec. 7052 124
  Office Test Record—A.A.R. Sig. Sec. 7051 124
Electrical Apparatus, D.C.:
  Daily Field Test Record—A.A.R. Sig. Sec. 7016 126
  Office Test Record—A.A.R. Sig. Sec. 7015 126
Electrical Windings:
  Impregnating Compound Treatment of—Requisites 171
  Varnish Treatment of—Requisites 174
Electrolyte, Specification for 13
Electro-Mechanical and Mechanical Interlocking—Specification 66 (66-37) 76
Electro-Mechanical Interlocking Machine—Specification 134 (134-39) 193
Electro-Pneumatic Interlocking—Specification 67 (6733) 79
Electro-Pneumatic Switch Operating Mechanism—Specification 152 (152-39) 30
Emergencies, Protection by Signal in—Requisite 47
Enameled Round Copper Magnet Wire; Specification for 183
Example of Application of Symbols and Wire Nomenclature 33
Example of Use of Unit Value Basis 203
Expenditures, Train Control; Guide for Allocating 74
Facilities, Joint Signal:
  Agreements on Principles Applicable to 57
  Construction Cost Detail 57
Factor Correction, Power; Capacitor for—Specification 160 (160-39) 100
Factors Which Govern in Determining the Type of Interlocking Which Should Be Installed 198
Fibre Conduit, Specification for 37
Fibre, Hard—Specification 13 (13-39) 58
Fibrous-Covered Non-Metallic Sheath for Railway Signal Cable—Specification 161 (161-39) 36
Field Test Record, Daily:
  A.C. Electrical Apparatus—A.A.R. Sig. Sec. 7052 124
  D.C. Electrical Apparatus—A.A.R. Sig. Sec. 7016 126
Filling and Sealing Recesses in Signal Apparatus, Insulating Material for—Specification 177 (177-39) 60
Findings and Conclusions—See Conclusions and Findings.
Flasher Relay—Specification 185 (185-39) 143
Flexible Conductors, Stranded and; Wires Required for—Table 189
Floating Battery Record Card—A.A.R. Sig. Sec. 7057 14
Forecast of the Value of Signaling—Form 24 29
Foreign Current on Direct Current Track Circuits; Minimizing the Effect of—Requisites 127
Forms:
  17—Insulation Resistance Record 130
  24—Forecast of the Value of Signaling 29
  7000—Nickel, Iron, Alkaline Storage Battery Report 16
  7001—Nickel, Iron, Alkaline Storage Battery Capacity Test 16
  7002—Switch Circuit Controller Shunting Circuit Resistance Test 195
  7003—Train Shunt Resistance Test 196
  7004—Fouling Protection—Turnouts and Crossovers 206
  7007—Primary Battery Record 7
  7015—Office Test Record of D.C. Electrical Apparatus 126

Part

Forms—Continued:
  7016—Daily Field Test Record of D.C. Electrical Apparatus 126
  7017—D.C. Relay Record Tag 126
  7018—Repair Tag 124, 126
  7021—Direct Current Track Circuit Test Record 131
  7022—Direct Current Track Circuit Test Record 131
  7050—Signal and Interlocking Unit Distribution 203
  7051—Office Test Record of A.C. Electrical Apparatus 124
  7052—Daily Field Test Record of A.C. Electrical Apparatus 124
  7053—A.C. Relay Record Tag 124
  7054—Performance Report—Automatic Highway Grade Crossing Protection 150
  7055—Record of Bulb Performance 120
  7056—Lead Acid Type Storage Battery Report 14
  7057—Floating Battery Record Card 14
  7058—Resistances of Single and Duplex Conductor Plug Type Rail Bonds and Track Circuit Connectors 112
  Agreement for Interlocking Plant 57
  Construction Contract, Proposal, and Bond 45
  Load Diagram for Calculating Power Supply and Distribution, A.C. Signal System 118
  Test of Hard Fibre 58
  Wire Inspection Report 178
Formula:
  Computing Minimum Allowable Resistance between Track Battery and Track 132
  Computing the Current Discharge from Battery with the Selected Train Shunt Resistance RS 132
  Computing the Maximum Battery Voltage EB when the Train Shunt Resistance and the Minimum Allowable Resistance in Series with Battery has been Selected 132
Formulae for Computing Minimum Allowable Resistance between Track Battery and Track and for Computing Related Current and Voltage Data 132
Forty-Five Degrees Below Zero Fahrenheit Lubricating Oil—Specification 103 (103-39) 107
Forty Per Cent Conductivity Copper-Covered Steel Bonding Wire—Specification 70 (70-39) 176
Fouling Protection—Turnouts and Crossovers—A.R.A. Sig. Sec. 7004 206
Friction Tape for Railroad Use—Specification 82 (8226) 157
Frost Conditions, Minimizing Condensation and—Requisites 188
Fuses—Specification 96 (96-39) 62
Galvanized Copper Bearing Steel Line Wire; Specification for 181
Galvanized E.B.B. Steel Bonding Wire—Specification 22 (22-39) 177
Galvanizing for Iron or Steel—Specification 29 (29-39) 63
Gates, Automatic—Highway Crossings at Grade over Railway Tracks—Requisites 35
General Classification for Signal Interruptions 52
Generator:
  Alternating Current—Specification 73 (73-39) 2
  Direct Current—Specification 14 (14-39) 65
Glasses, Signal—Specification 69 (69-39) 136
Globes, Hand Lantern; Kerosene—Specification 59 (59-39) 66
Grade Crossing Protection, Highway:
  Automatic—Performance Report—A.A.R. Sig. Sec. 7054 150
  Conclusion and Findings 103
Grade Crossing Signals, Highway:
  Requisites 148
  Specification 176 (176-37) 149

Part
Grade Crossing Signs, Railroad Highway—Specification 155 (155-39) 44
Grade or Tonnage Signals—Conclusion and Findings 103
Grade Signal Markers 78
Gravity Classification Yards, Signaling for 42
Gray Iron Castings, Specification for 88
Grooved Trunking, Capping and; Preservative Treatment of—Specification 140 (140-39) 202
Ground, Made, for Protection Against Abnormal Potentials; Installation of—Specification 60 (60-39) 92
Guide for Allocating Train Control Expenditures 74
Guy and Messenger Strand:
  Bronze, Specification for 70
  Copper-Covered Steel—Specification 173 (173-39) 69
  Steel, Specification for 184
Hand Lantern Globes, Kerosene—Specification 59 (59-39) 66
Handling Dry Cells; Maintaining and—Instructions 73
Handling Insulated Wires and Cables—Instructions 190
Hard-Drawn Copper Line Wire, Bare—Specification 169 (169-39) 182
Hard Fibre—Specification 13 (13-39) 58
Hardware, Pole Line; Specification for 51
Heat Treating or Track Welding in Track Circuit Territory—Requisites 156
High Tensile Strength Metals and Alloys for Binding Posts, Machine Screws, Nuts, Washers, etc., Used in Signal Apparatus—Specification 159 (159-39) 119
Highway Crossing Bell, Direct Current Vibrating—Specification 44 (44-39) 21
Highway Crossing Gate, Automatic—Requisites 35
Highway Grade Crossing Protection—Conclusion and Findings 103
Highway Grade Crossing Protection, Automatic—Performance Report—A.A.R. Sig. Sec. 7054 150
Highway Grade Crossing Signals:
  Requisites 148
  Specification 176 (176-37) 149
  Train Approach Signals 159
Highway Grade Crossing Signs, Railroad—Specification 155 (155-39) 44
Impedance Bond—Specification 74 (74-39) 67
Impedance Bonds, Petrolatum for Use in—Specification 77 (7719) 111
Impregnating Compound Treatment of Electrical Windings—Requisites 171
Incandescent Electric Lamps—Specification 51 (51-39) 91
Indication, Signal, Train Operation by—Conclusion and Findings 103
Indications, Aspects and; Cab Signal 1
Indications, Aspects and, for Continuous Automatic Cab Signals 1
Indicators:
  Switch—Requisites 72
  Take Siding and Leave Siding for Non-Interlocked Switch—Requisites 71
Inspecting and Testing—Instructions:
  Automatic Interlocking 59
  Mechanical Locking of an Interlocking Machine 200
Inspecting, Maintaining and Testing Spring Switches—Instructions 140
Inspecting, Testing and Maintaining Relays—Instructions:
  Alternating Current 124
  Direct Current 126
Inspecting, Testing and Maintaining Switch Circuit Controllers—Instructions 134
Inspecting, Testing, Maintaining and Installing Insulated Rail Joints—Instructions 133
Inspection Report, Wire 178

Part

- Installation:
  - Batteries, Storage:
    - Lead Acid Type—Instructions 14
    - Nickel, Iron, Alkaline—Instructions 16
  - Cells, Primary, Copper-Oxide Caustic Soda; Installation and Maintenance of—Instructions 7
  - Made Ground for Protection Against Abnormal Potentials—Specification 60 (60-39) 92
  - Switchboard; Operation and—Instructions 154
- Installing, Inspecting, Testing and Maintaining Insulated Rail Joints—Instructions 133
- Instructions:
  - Handling Insulated Wires and Cables 190
  - Inspecting and Testing Automatic Interlocking 59
  - Inspecting and Testing Mechanical Locking of an Interlocking Machine 200
  - Inspecting, Testing and Maintaining Alternating Current Relays 124
  - Inspecting, Testing and Maintaining Direct Current Relays 126
  - Inspecting, Testing and Maintaining Switch Circuit Controllers 134
  - Installation and Maintenance of Copper-Oxide Caustic Soda Primary Cells 7
  - Installation and Operation of Switchboard 154
  - Installation, Maintenance and Operation of Lead Acid Type Storage Batteries 14
  - Installation, Maintenance and Operation of Nickel, Iron, Alkaline Storage Batteries 16
  - Installing, Inspecting, Testing and Maintaining Insulated Rail Joints 133
  - Maintaining and Handling Dry Cells 73
  - Maintaining and Operating Rectifiers 68
  - Maintaining and Testing:
    - Car Retarder Systems 125
    - Electric Lamps 120
    - Interlocking Plants 138
    - Light Signals 61
    - Motor Semaphore Signals 54
  - Maintaining, Inspecting and Testing Spring Switches 140
  - Maintenance and Operation of Alternating Current Track Circuits 162
  - Maintenance and Operation of Direct Current Track Circuits 8
  - Setting of Time Releases Applied to Signal Apparatus 128
  - Signal Maintenance 102
  - Testing Electric Locking 199
- Insulated Rail Joints; Installing, Inspecting, Testing and Maintaining—Instructions 133
- Insulated Wire; Mineral Matter Rubber Compound—Specification 111 (111-39) 186
- Insulated Wires and Cables; Instructions for Handling 190
- Insulating Material for Filling and Sealing Recesses in Signal Apparatus—Specification 177 (177-39) 60
- Insulating Tape, Rubber—Specification 56 (5632) 158
- Insulation, Porcelain, Dry Process—Specification 144 (144-39) 80
- Insulation Resistance, Measurement of 130
- Insulators, Porcelain; Pin Type—Specification 146 (146-39) 160
- Interlocking:
  - At Drawbridges for the Protection of Train Movements—Specification 175 (175-38) 64
  - Automatic—Specification 141 (141-34) 208
  - Automatic, Inspecting and Testing—Instructions 59

Part

Interlocking—Continued:
  Electric—Specification 65 (65-37) 75
  Electro-Mechanical and Mechanical—Specification 66 (66-37) 76
  Electro-Pneumatic—Specification 67 (6733) 79
  Factors which Govern in Determining the Type which Should be Installed 198
Interlocking and Signal Units; Table of 203
Interlocking Lever Circuit Controller—Specification 138 (138-39) 197
Interlocking Machine, Electric—Specification 76 (76-39) 85
Interlocking Machine, Electro-Mechanical—Specification 134 (134-39) 193
Interlocking Machine, Inspecting and Testing Mechanical Locking of—Instructions 200
Interlocking Machine, Mechanical:
  S. & F. Locking—Specification 75 (75-39) 82
  Style "A" Locking—Specification 114 (114-39) 83
Interlocking Machines, Mechanically Locking the Levers of—Requisites 99
Interlocking, Mechanical; Electro-Mechanical and—Specification 66 (66-37) 76
Interlocking Plants:
  Form of Agreement for 57
  Maintaining and Testing—Instructions 138
Interlocking Relay, Tractive Armature Direct Current Neutral—Specification 186 (186-39) 105
Interlocking System—Requisites 94
Interlocking Unit Distribution, Signal and—A.A.R. Sig. Sec. 7050 203
Interlocking Units, Signal and; Table of 203
Interlockings—Conclusion and Findings:
  Automatic 103
  Consolidation of 103
  Manually-Operated 103
Interruptions, Signal; General Classification for 52
Iron, Alkaline Storage Batteries, Nickel; Installation, Maintenance and Operation—Instructions 16
Iron, Alkaline Storage Battery; Nickel—Specification 49 (49-39) 15
Iron Bars, Refined; Specification for 90
Iron Bars, Wrought; Specification for 90
Iron Castings:
  Gray, Specification for 88
  Malleable, Specification for 89
Iron or Steel, Galvanizing for—Specification 29 (29-39) 63
Iron Pipe Conduit, Wrought—Specification 37 (3713) 40
Iron Pipe; One-Inch Welded Wrought—Specification 123 (123-39) 116
Jar, Primary Battery—Specification 113 (113-39) 9
Joint Signal Facilities:
  Agreements on Principles Applicable to 57
  Construction Cost Detail 57
Joints, Rail, Insulated; Installing, Inspecting, Testing and Maintaining—Instructions 133
Joints, Wire—Specification 110 (11033) 179
Kerosene Hand Lantern Globes—Specification 59 (59-39) 66
Lamp Case, Electric—Specification 174 (174-39) 12
Lamps:
  Electric, Maintaining and Testing—Instructions 120
  Incandescent Electric—Specification 51 (51-39) 91
  Life Hours for; Table of 120
  Oil Lighted—Specification 137 (137-39) 204
  Signal and Switch, Electric Lighting of—Conclusion and Findings 103
Lantern Globes, Hand; Kerosene—Specification 59 (59-39) 66

Part

Layout, Signal; for Remote Switches 194
Lead Acid Stationary Storage Battery:
  Plates of Alloy Composition Supporting Active Material in Paste Form—Specification 158 (158-39) 117
  Plates of Composite Structure Supporting Active Material in the Form of Pure Lead—Specification 53 (53-39) 18
  Plates of Pure Lead, Electro-Chemically Formed, in Combination with Plates of Alloy Supporting Material in Paste Form—Specification 58 (58-39) 19
Lead Acid Type Storage Batteries; Installation, Maintenance and Operation of—Instructions 14
Lead Acid Type Storage Battery, Electrolyte for; Specification for 13
Lead Acid Type Storage Battery Report—A.A.R. Sig. Sec. 7056 14
Lead-Covered Cable—Specification 91 (91-39) 28
Lead Type Storage Battery, Stationary; Pure—Specification 58 (58-39) 19
Leave Siding Indicator and Take Siding Indicator for Non-Interlocked Switch—Requisites 71
Lever, Interlocking, Circuit Controller—Specification 138 (138-39) 197
Levers, Mechanically Locking, of Interlocking Machines—Requisites 99
Life Hours for Lamps; Table of 120
Light Signal:
  Color, Operating Mechanism, Electric; Searchlight Type—Specification 157 (157-39) 93
  Electric:
    Color—Specification 80 (80-39) 146
    Color Position—Specification 162 (162-39) 50
    Position—Specification 81 (81-39) 147
  Maintaining and Testing—Instructions 61
  Searchlight, Color; Operating Characteristics—Table 61
Light Traffic Railroads Crossing at Grade, Signal Protection for—Conclusion and Findings 103
Lighting, Electric, of Signal and Switch Lamps—Conclusion and Findings 103
Lighting, Series Line Approach; Tractive Armature Direct Current Neutral Relay for—Specification 154 (154-39) 101
Lightning Arrester, Low-Voltage—Specification 52 (52-39) 95
Lightning, Minimizing the Effect of, on Track Circuits—Requisites 81
Line and Track Circuits; Air-Cooled Reactor for—Specification 104 (104-39) 121
Line Approach Lighting, Series; Tractive Armature Direct Current Neutral Relay for—Specification 154 (154-39) 101
Line Wire:
  Bare Copper Alloy, Thirty Per Cent Conductivity—Specification 168 (168-39) 173
  Bare Copper-Covered Steel, Thirty Per Cent Conductivity—Specification 167 (167-39) 180
  Bare Hard-Drawn Copper—Specification 169 (169-39) 182
  Steel, Galvanized Copper Bearing; Specification for 181
  Stringing Sags for New 163
  Weatherproof Covering for—Specification 163 (163-39) 46
Lines, Pipe; Compensation of, for the Operation of Mechanical Units—Specification 121 (121-27) 113
Load Diagram for Calculating Power Supply and Distribution, A.C. Signal System 118
Locking:
  Electric; Testing—Instructions 199
  Mechanical, of an Interlocking Machine; Inspecting and Testing—Instructions 200

Part

Locking—Continued:
  Mechanically, the Levers of Interlocking Machines—Requisites 99
  S. & F. Mechanical Interlocking Machine—Specification 75 (75-39) 82
  Style "A"; Mechanical Interlocking Machine—Specification 114 (114-39) 83
Locks, Electric—Specification 99 (99-39) 96
Low-Voltage Lightning Arrester—Specification 52 (52-39) 95
Lubricating Oil:
  45 Degrees Below Zero Fahrenheit—Specification 103 (103-39) 107
  Zero Fahrenheit—Specification 102 (102-39) 106
Machine, Centralized Traffic Control—Specification 150 (150-39) 98
Machine Screws, Brass and High Tensile Strength Metals and Alloys for—Specification 159 (159-39) 119
Machines, Interlocking:
  Electric—Specification 76 (76-39) 85
  Electro-Mechanical—Specification 134 (134-39) 193
  Inspecting and Testing Mechanical Locking of—Instructions 200
  Mechanical:
    S. & F. Locking—Specification 75 (75-39) 82
    Style "A" Locking—Specification 114 (114-39) 83
  Mechanically Locking the Levers of—Requisites 99
Made Ground for Protection Against Abnormal Potentials; Installation of—Specification 60 (60-39) 92
Magnet Wire, Enameled Round Copper; Specification for 183
Maintaining and Handling Dry Cells—Instructions 73
Maintaining and Operating Rectifiers—Instructions 68
Maintaining and Testing—Instructions:
  Car Retarder Systems 125
  Electric Lamps 120
  Insulated Rail Joints 133
  Interlocking Plants 138
  Light Signals 61
  Motor Semaphore Signals 54
  Switch Circuit Controllers 134
Maintaining, Inspecting and Testing Spring Switches—Instructions 140
Maintaining Relays; Inspecting, Testing and—Instructions:
  Alternating Current 124
  Direct Current 126
Maintenance and Operation:
  Alternating Current Track Circuits—Instructions 162
  Direct Current Track Circuits—Instructions 8
  Lead Acid Type Storage Batteries, Instructions for Installation 14
  Nickel, Iron, Alkaline Storage Batteries; Instructions for Installation 16
Maintenance, Installation and, of Copper-Oxide Caustic Soda Primary Cells—Instructions 7
Maintenance, Signal—Instructions 102
Malleable Iron Castings, Specification for 89
Manually-Operated Interlockings—Conclusion and Findings 103
Markers:
  Grade Signal 78
  Spring Switch 77
Material, Insulating, for Filling and Sealing Recesses in Signal Apparatus—Specification 177 (177-39) 60
Maximum Battery Voltage EB when the Train Shunt Resistance and the Minimum Allowable Resistance in Series with Battery has been Selected, Formula for Computing the 132
Measurement of Insulation Resistance 130
Mechanical and Electro-Mechanical Interlocking—Specification 66 (66-37) 76

Part

- Mechanical Interlocking Machine:
  - S. & F. Locking—Specification 75 (75-39) 82
  - Style "A" Locking—Specification 114 (114-39) 83
- Mechanical Locking of an Interlocking Machine, Inspecting and Testing—Instructions 200
- Mechanical Time Release—Specification 128 (128-39) 129
- Mechanical Units; Compensation of Pipe Lines for the Operation of—Specification 121 (121-27) 113
- Mechanically Applied Rail Head Type Bonds and Track Circuit Connectors—Specification 179 (179-39) 142
- Mechanically Locking the Levers of Interlocking Machines—Requisites 99
- Mechanism, Operating, Electric Color Light Signal, Searchlight Type—Specification 157 (157-39) 93
- Mechanism, Switch Operating:
  - Electric Motor—Specification 101 (101-39) 104
  - Electro-Pneumatic—Specification 152 (152-39) 30
- Messenger Strand, Guy and:
  - Bronze, Specification for 70
  - Copper-Covered Steel—Specification 173 (173-39) 69
  - Steel, Specification for 184
- Messenger Wires, Recommended Sags for 185
- Metals and Alloys, High Tensile Strength, for Binding Posts, Machine Screws, Nuts, Washers, etc., Used in Signal Apparatus—Specification 159 (159-39) 119
- Method of Making Service Test of Motor Semaphore Signals 54
- Method of Making Shop and Field Electrical Torque Tests of Motor Semaphore Signals 54
- Method of Making Shop Torque Tests at the Semaphore Shaft of Motor Semaphore Signals 54
- Mineral Matter Rubber Compound Insulated Wire—Specification 111 (111-39) 186
- Minimizing Condensation and Frost Conditions—Requisites 188
- Minimizing the Effect of:
  - Foreign Current on Direct Current Track Circuits—Requisites 127
  - Lightning on Track Circuits—Requisites 81
- Minimum Allowable Resistance Between Track Battery and Track and for Computing Related Current and Voltage Data; Formulae for Computing 132
- Minimum Allowable Resistance in Series with Track Battery for Standard or Conventional Direct Current Track Circuits, Tables of 132
- Minimum Allowable Resistance in Series with Track Battery for Various Train Shunt Resistances and Various Maximum Battery Terminal Voltages, for Standard or Conventional Track Circuits; Curves for Determining the 132
- Motor Semaphore Signals:
  - Electric—Specification 79 (79-39) 144
  - Maintaining and Testing—Instructions 54
- Motor Switch, Electric; Operating Mechanism—Specification 101 (101-39) 104
- Movable Bridges; Requirements for the Protection of Traffic at 23
- Movements, Train; Interlocking at Drawbridges for the Protection of—Specification 175 (175-38) 64
- Multiple Unit Terminal Block—Specification 183 (183-39) 155
- Neutral Relay, Tractive Armature Direct Current:
  - Centralized Traffic Control Detachable Type—Specification 180 (180-39) 145
  - For Series Line Approach Lighting—Specification 154 (154-39) 101
  - Interlocking—Specification 186 (186-39) 105
  - With Two or More Contact Fingers—Specification 105 (105-39) 123

Part

Nickel, Iron, Alkaline Storage Batteries; Installation, Maintenance and Operation—Instructions 16
Nickel, Iron, Alkaline Storage Battery—Specification 49 (49-39) 15
Nomenclature, Circuit, and Written Circuits 33
Nomenclature, Wire; Example of Application of Symbols and 33
Non-Interlocked Switch, Take Siding Indicator and Leave Siding Indicator for—Requisites 71
Non-Metallic Sheath, Fibrous-Covered, for Railway Signal Cable—Specification 161 (161-39) 36
No. 6 Dry Cell, Specification for 31
Nuts, Bolts, and Threads; Specification for 17
Nuts, Brass and High Tensile Strength Metals and Alloys for—Specification 159 (159-39) 119
Office Test Record of Electrical Apparatus:
  Alternating Current—A.A.R. Sig. Sec. 7051 124
  Direct Current—A.A.R. Sig. Sec. 7015 126
Oil-Immersed, Self-Cooled Transformer—Specification 84 (84-39) 165
Oil Lighted Lamp—Specification 137 (137-39) 204
Oil, Lubricating:
  45 Degrees Below Zero Fahrenheit—Specification 103 (103-39) 107
  Zero Fahrenheit—Specification 102 (102-39) 106
Oil, Transformer—Specification 46 (46-39) 108
One-Inch Welded Steel Pipe—Specification 122 (122-39) 114
One-Inch Welded Wrought Iron Pipe—Specification 123 (123-39) 116
Operating Characteristics—Tables:
  Model 2-A Signals 54
  Relays:
    Alternating Current 124
    Direct Current 126
  Searchlight, Color Light Signals 61
  Style L Signals 54
  Styles S and B Signals 54
  T-2 Signals 54
Operating Mechanism, Electric Color Light Signal, Searchlight Type—Specification 157 (157-39) 93
Operating Mechanism, Switch:
  Electric Motor—Specification 101 (101-39) 104
  Electro-Pneumatic—Specification 152 (152-39) 30
Operating Rectifiers, Maintaining and—Instructions 68
Operation:
  Alternating Current Track Circuits, Maintenance and—Instructions 162
  Batteries, Storage:
    Lead Acid Type; Installation, Maintenance and—Instructions 14
    Nickel, Iron, Alkaline; Installation, Maintenance and—Instructions 16
  Direct Current Track Circuits; Maintenance and—Instructions 8
  Mechanical Units, Compensation of Pipe Lines for—Specification 121 (121-27) 113
  Switchboard; Installation and—Instructions 154
  Train, by Signal Indication—Conclusion and Findings 103
Overlaps in Connection with Automatic Signal Systems 109
Paint and Painting:
  Braid-Covered Aerial Wires and Cables:
    Cable Paint—Asphalt or Coal Tar Emulsion—Specification 187 (187-39) 152
    Cable Paint—Volatile Thinner—Specification 181 (181-39) 151
  Specification 120 (120-39) 110
Parkway Cable—Specification 145 (145-39) 20
Performance, Bulb; Record of—A.A.R. Sig. Sec. 7055 120

Part
Performance Report—Automatic Highway Grade Crossing Protection—A.A.R. Sig. Sec. 7054 150
Performance, Train, on Single Track; Economical—Conclusion 103
Petrolatum for Use in Impedance Bonds—Specification 77 (7719) 111
Pin Type Porcelain Insulators—Specification 146 (146-39) 160
Pins, Channel—Specification 23 (23-39) 32
Pipe Conduit:
  Steel—Specification 36 (3613) 39
  Wrought Iron—Specification 37 (3713) 40
Pipe Lines, Compensation of, for the Operation of Mechanical Units—Specification 121 (121-27) 113
Pipe, One-Inch Welded Wrought Iron—Specification 123 (123-39) 116
Pipe, Steel; One-Inch Welded—Specification 122 (122-39) 114
Pipe Thread 115
Plant, Interlocking; Form of Agreement for 57
Plants, Interlocking; Maintaining and Testing—Instructions 138
Plug Type Rail Bonds and Track Circuit Connectors:
  Resistances of Single and Duplex Conductor—A.A.R. Sig. Sec. 7058 112
  Specification 151 (151-39) 112
Polarized Relay, Direct Current; Tractive Armature—Specification 165 (165-39) 137
Pole Line Hardware; Specification for 51
Porcelain Insulation, Dry Process—Specification 144 (144-39) 80
Porcelain Insulators; Pin Type—Specification 146 (146-39) 160
Portable:
  Alternating Current Ammeter—Specification 112 (112-39) 3
  Alternating Current Voltmeter—Specification 115 (115-39) 169
  Direct Current Voltmeters, Ammeters and Volt-Ammeters—Specification 85 (85-39) 168
Position Light Signal, Electric:
  Color—Specification 162 (162-39) 50
  Specification 81 (81-39) 147
Posts, Binding; Brass and High Tensile Strength Metals and Alloys for—Specification 159 (159-39) 119
Potentials, Abnormal; Installation of Made Ground for Protection Against—Specification 60 (60-39) 92
Power Factor Correction, Capacitor for—Specification 160 (160-39) 100
Power Supply and Distribution Calculations, Alternating Current 118
Power Supply and Trolley Lines Crossing Railways, Electric Light; Railroad Specifications for 191
Power Transfer Relay, Alternating Current—Specification 148 (148-39) 53
Preservative Treatment of Capping and Grooved Trunking—Specification 140 (140-39) 202
Primary Battery:
  Jar—Specification 113 (113-39) 9
  Record—A.A.R. Sig. Sec. 7007 7
Primary Cells, Copper-Oxide Caustic Soda:
  Installation and Maintenance—Instructions 7
  Type "A"—Specification 87 (87-39) 6
  Type "B"—Specification 171 (171-39) 4
Principles Applicable to Joint Signal Facilities, Agreements on 57
Proposal; Forms of Construction Contract, and Bond 45
Protection Against Abnormal Potentials; Installation of Made Ground for—Specification 60 (60-39) 92
Protection by Signal in Emergencies—Requisite 47
Protection, Fouling—Turnouts and Crossovers—A.R.A. Sig. Sec. 7004 206
Protection, Highway Grade Crossing:
  Automatic—Performance Report—A.A.R. Sig. Sec. 7054 150
  Conclusion and Findings 103

Part
Protection of Traffic at Movable Bridges, Requirements for the 23
Protection of Train Movements, Interlocking at Drawbridges for the—Specification 175 (175-38) 64
Protection, Signal, for Light Traffic Railroads Crossing at Grade—Conclusion and Findings 103
Protection, Signal, for Spring Switches—Requisites 10
Pure Lead Type Stationary Storage Battery—Specification 58 (58-39) 19
Rail Bonding, Track Circuit—Specification 135 (135-39) 22
Rail Bonds, Plug Type, and Track Circuit Connectors:
  Resistances of Single and Duplex Conductor—A.A.R. Sig. Sec. 7058 112
  Specification 151 (151-39) 112
Rail Head Bonds and Track Circuit Connectors:
  Mechanically Applied Type—Specification 179 (179-39) 142
  Welded Type—Specification 178 (178-39) 141
Rail Joints, Insulated; Installing, Inspecting, Testing and Maintaining—Instructions 133
Railroad Highway Grade Crossing Signs—Specification 155 (155-39) 44
Railroad Specifications for Electric Light, Power Supply and Trolley Lines Crossing Railways 191
Railroads, Light Traffic, Crossing at Grade; Signal Protection for—Conclusion and Findings 103
Ranges, Voltage; for Signal Work 170
Reactor, Air-Cooled; for Line and Track Circuits—Specification 104 (104-39) 121
Recesses, Insulating Material for Filling and Sealing, in Signal Apparatus—Specification 177 (177-39) 60
Recommended Sags for Messenger Wires 185
Record Card, Floating Battery—A.A.R. Sig. Sec. 7057 14
Record of Bulb Performance—A.A.R. Sig. Sec. 7055 120
Record; Primary Battery—A.A.R. Sig. Sec. 7007 7
Record Tag, Relay:
  A.C.—A.A.R. Sig. Sec. 7053 124
  D.C.—A.A.R. Sig. Sec. 7017 126
Record, Test:
  Daily, Field:
    A.C. Electrical Apparatus—A.A.R. Sig. Sec. 7052 124
    D.C. Electrical Apparatus—A.A.R. Sig. Sec. 7016 126
  Office:
    A.C. Electrical Apparatus—A.A.R. Sig. Sec. 7051 124
    D.C. Electrical Apparatus—A.A.R. Sig. Sec. 7015 126
  Track Circuit, D.C.—A.R.A. Sig. Sec. 7021 and 7022 131
Rectifiers and Valves, Copper-Oxide—Specification 166 (166-39) 139
Rectifiers, Maintaining and Operating—Instructions 68
Refined Iron Bars, Specification for 90
Reflector Unit—Specification 156 (156-39) 43
Reinforced Cable, Steel; Aerial Aluminum—Specification 54 (54-39) 24
Relay, Flasher—Specification 185 (185-39) 143
Relay Record Tag:
  A.C.—A.A.R. Sig. Sec. 7053 124
  D.C.—A.A.R. Sig. Sec. 7017 126
Relay, Tractive Armature Direct Current Neutral:
  Centralized Traffic Control Detachable Type—Specification 180 (180-39) 145
  For Series Line Approach Lighting—Specification 154 (154-39) 101
  Interlocking—Specification 186 (186-39) 105
  With Two or More Contact Fingers—Specification 105 (105-39) 123
Relay, Tractive Armature Direct Current Polarized—Specification 165 (165-39) 137

Part

Relays, Alternating Current:
  Inspecting, Testing and Maintaining—Instructions 124
  Operating Characteristics of—Table I 124
  Power Transfer—Specification 148 (148-39) 53
  Record Tag—A.A.R. Sig. Sec. 7053 124
  Repair Tag—A.A.R. Sig. Sec. 7018 124
  Specification 78 (78-39) 122
Relays, Direct Current:
  Inspecting, Testing and Maintaining—Instructions 126
  Operating Characteristics of—Table I 126
  Record Tag—A.A.R. Sig. Sec. 7017 126
  Repair Tag—A.A.R. Sig. Sec. 7018 126
Release, Mechanical Time—Specification 128 (128-39) 129
Releases, Time; Instructions for Setting of, Applied to Signal Apparatus 128
Remote Control—Conclusion and Findings 103
Remote Switches, Signal Layout for 194
Repair Tag—A.A.R. Sig. Sec. 7018 124, 126
Report:
  Lead Acid Type Storage Battery—A.A.R. Sig. Sec. 7056 14
  Nickel, Iron, Alkaline Storage Battery—A.A.R. Sig. Sec. 7000 16
  Performance—Automatic Highway Grade Crossing Protection—A.A.R. Sig. Sec. 7054 150
  Wire Inspection 178
Requirements, Protection of Traffic at Movable Bridges 23
Requisites:
  Automatic Block Signal System 87
  Automatic Block Signaling Circuits 34
  Automatic Gates—Highway Crossings at Grade over Railway Tracks 35
  Centralized Traffic Control System 86
  Highway Grade Crossing Signals 148
  Impregnating Compound Treatment of Electrical Windings 171
  Interlocking System 94
  Mechanically Locking the Levers of Interlocking Machines 99
  Minimizing Condensation and Frost Conditions 188
  Minimizing the Effect of:
    Foreign Current on Direct Current Track Circuits 127
    Lightning on Track Circuits 81
  Protection by Signal in Emergencies 47
  Signal Protection for Spring Switches 10
  Switch Indicators 72
  Take Siding Indicator and Leave Siding Indicator for Non-Interlocked Switch 71
  Track Welding or Heat Treating in Track Circuit Territory 156
  Varnish Treatment of Electrical Windings 174
Resistance, Insulation—Measurement of 130
Resistance, Minimum Allowable, between Track Battery and Track and for Computing Related Current and Voltage Data; Formulae for Computing 132
Resistance, Minimum Allowable, in Series with Track Battery for Standard or Conventional Direct Current Track Circuits; Tables of 132
Resistance, Minimum Allowable, in Series with Track Battery for Various Train Shunt Resistances and Various Maximum Battery Terminal Voltages for Standard or Conventional Track Circuits; Curves for Determining 132
Resistance Test:
  Switch Circuit Controller Shunting Circuit—A.R.A. Sig. Sec. 7002 195
  Train Shunt—A.R.A. Sig. Sec. 7003 196

Part
Resistances of Single and Duplex Conductor Plug Type Rail Bonds and Track Circuit Connectors—A.A.R. Sig. Sec. 7058 112
Resistor—Specification 106 (106-39) 135
Retarder System, Car—Specification 147 (147-35) 27
Retarder Systems, Car; Maintaining and Testing—Instructions 125
Retarders, Car—Conclusion and Findings 103
Round Copper Magnet Wire, Enameled; Specification for 183
Rubber Compound Insulated Wire, Mineral Matter—Specification 111 (111-39) 186
Rubber-Insulated Wire and Cable, Aerial; Weather-Resisting Braid Coverings for—Specification 182 (182-39) 172
Rubber Insulating Tape—Specification 56 (5632) 158
Rubber Insulation Resistance in Megohms Per Mile at 60 Degrees Fahrenheit; Table of 187
S. & F. Locking, Mechanical Interlocking Machine—Specification 75 (75-39) 82
Sags for Messenger Wires, Recommended 185
Sags, Stringing, for New Line Wires 163
Screws, Machine; Brass and High Tensile Strength Metals and Alloys for—Specification 159 (159-39) 119
Sealing Recesses in Signal Apparatus, Insulating Material for Filling and—Specification 177 (177-39) 60
Searchlight, Color Light Signals; Table of Operating Characteristics 61
Searchlight Type Electric Color Light Signal Operating Mechanism—Specification 157 (157-39) 93
Self-Cooled Transformer; Oil-Immersed—Specification 84 (84-39) 165
Semaphore Signals, Motor:
  Electric—Specification 79 (79-39) 144
  Maintaining and Testing—Instructions 54
Series Line Approach Lighting, Tractive Armature Direct Current Neutral Relay for—Specification 154 (154-39) 101
Service Test of Motor Semaphore Signals, Method of Making 54
Setting of Time Releases Applied to Signal Apparatus—Instructions 128
Sheath, Fibrous-Covered Non-Metallic, for Railway Signal Cable—Specification 161 (161-39) 36
Shop and Field Electrical Torque Tests of Motor Semaphore Signals, Method of Making 54
Shunt Resistance, Train:
  Curves for Determining the Minimum Allowable Resistance in Series with Track Battery for Various, and Various Maximum Battery Terminal Voltages, for Standard or Conventional Track Circuits 132
  Test—A.R.A. Sig. Sec. 7003 196
Shunting Circuit Resistance Test, Switch Circuit Controller—A.R.A. Sig. Sec. 7002 195
Siding Indicator, Take, and Leave Siding Indicator, for Non-Interlocked Switch—Requisites 71
Signal and Interlocking Unit Distribution—A.A.R. Sig. Sec. 7050 203
Signal and Interlocking Units, Table of 203
Signal: (See also Signals.)
  Apparatus, Minimizing Condensation and Frost Conditions—Requisites 188
  Block System, Automatic—Requisites 87
  Cab, Aspects and Indications 1
  Color Light:
    Electric—Specification 80 (80-39) 146
      Position—Specification 162 (162-39) 50
    Operating Mechanism, Electric Searchlight Type—Specification 157 (157-39) 93

Part

Signal—Continued:
  Lamps, Electric Lighting of Switch and—Conclusion and Findings 103
  Motor Semaphore, Electric—Specification 79 (79-39) 144
  Position Light, Electric—Specification 81 (81-39) 147
  Protection by, in Emergencies—Requisite 47
Signal Facilities, Joint:
  Agreements on Principles Applicable to 57
  Construction Cost Detail 57
Signal Glasses—Specification 69 (69-39) 136
Signal Indication, Train Operation by—Conclusion and Findings 103
Signal Interruptions, General Classification for 52
Signal Layout for Remote Switches 194
Signal Maintenance—Instructions 102
Signal Markers, Grade 78
Signal Protection for Light Traffic Railroads Crossing at Grade—Conclusion and Findings 103
Signal Protection for Spring Switches—Requisites 10
Signal System, Automatic Block—Specification 63 (63-36) 5
Signal Systems, Automatic; Overlaps in Connection with 109
Signal Work, Voltage Ranges for 170
Signaling:
  For Gravity Classification Yards 42
  Forecast of the Value of—Form 24 29
  Technical Terms Used in—Definitions 55
Signaling Circuits, Automatic Block—Requisites 34
Signals: (See also Signal.)
  Application of 1
  Automatic Block—Conclusion and Findings 103
  Cab, Continuous Automatic; Aspects and Indications for 1
  Grade or Tonnage—Conclusions and Findings 103
  Highway Grade Crossing:
    Requisites 148
    Specification 176 (176-37) 149
  Light, Maintaining and Testing—Instructions 61
  Model 2-A, Operating Characteristics—Table 54
  Motor Semaphore, Maintaining and Testing—Instructions 54
  Searchlight, Color Light; Operating Characteristics—Table 61
  Style L, Operating Characteristics—Table 54
  Styles S and B, Operating Characteristics—Table 54
  T-2, Operating Characteristics—Table 54
  Train Approach 159
Signs, Railroad Highway Grade Crossing—Specification 155 (155-39) 44
Single and Duplex Conductor Plug Type Rail Bonds and Track Circuit Connectors, Resistances of—A.A.R. Sig. Sec. 7058 112
Single Track, Economical Train Performance on—Conclusion 103
Specification for:
  Bolts, Nuts and Threads 17
  Bronze Guy and Messenger Strand 70
  Communication Underground Conduit Construction 38
  Electrolyte 13
  Enameled Round Copper Magnet Wire 183
  Fibre Conduit 37
  Galvanized Copper Bearing Steel Line Wire 181
  Gray Iron Castings 88
  Malleable Iron Castings 89
  No. 6 Dry Cell 31
  Pole Line Hardware 51
  Refined Iron Bars 90

Part

Specification for—Continued:
Steel Guy and Messenger Strand 184
Telegraph, Telephone and other Communication Wires and Cables Crossing the Tracks of Steam and Electrified Railroads 192
Vitrified Clay Conduit 41
Wrought Iron Bars 90
Specifications:
13 (13-39) Hard Fibre 58
14 (14-39) Direct Current Generator 65
22 (22-39) Galvanized E.B.B. Steel Bonding Wire 177
23 (23-39) Channel Pins 32
29 (29-39) Galvanizing for Iron or Steel 63
36 (3613) Steel Pipe Conduit 39
37 (3713) Wrought Iron Pipe Conduit 40
44 (44-39) Direct Current Vibrating Highway Crossing Bell 21
46 (46-39) Transformer Oil 108
49 (49-39) Nickel, Iron, Alkaline Storage Battery 15
51 (51-39) Incandescent Electric Lamps 91
52 (52-39) Low-Voltage Lightning Arrester 95
53 (53-39) Lead Acid Stationary Storage Battery (Plates of Composite Structure) 18
54 (54-39) Aerial Aluminum Cable Steel Reinforced 24
56 (5632) Rubber Insulating Tape 158
57 (57-39) Trunking and Capping (Wood) 167
58 (58-39) Lead Acid Stationary Storage Battery (Plates of Pure Lead) 19
59 (59-39) Kerosene Hand Lantern Globes 66
60 (60-39) Installation of Made Ground for Protection Against Abnormal Potentials 92
63 (63-36) Automatic Block Signal System 5
65 (65-37) Electric Interlocking 75
66 (66-37) Electro-Mechanical and Mechanical Interlocking 76
67 (6733) Electro-Pneumatic Interlocking 79
69 (69-39) Signal Glasses 136
70 (70-39) Forty Per Cent Conductivity Copper-Covered Steel Bonding Wire 176
73 (73-39) Alternating Current Generator 2
74 (74-39) Impedence Bond 67
75 (75-39) Mechanical Interlocking Machine, S. & F. Locking 82
76 (76-39) Electric Interlocking Machine 85
77 (7719) Petrolatum for Use in Impedance Bonds 111
78 (78-39) Alternating Current Relay 122
79 (79-39) Electric Motor Semaphore Signal 144
80 (80-39) Electric Color Light Signal 146
81 (81-39) Electric Position Light Signal 147
82 (8226) Friction Tape for Railroad Use 157
83 (83-39) Air-Cooled Transformer 164
84 (84-39) Transformer, Oil-Immersed, Self-Cooled 165
85 (85-39) Portable Direct Current Voltmeters, Ammeters and Volt-Ammeters 168
87 (87-39) Type "A" Copper-Oxide Caustic Soda Primary Cell 6
89 (89-39) Aerial Braided Cable 25
90 (90-39) Armored Submarine Cable 26
91 (91-39) Lead-Covered Cable 28
95 (95-39) Universal Switch Circuit Controller 49
96 (96-39) Fuses 62
99 (99-39) Electric Locks 96
101 (101-39) Electric Motor Switch Operating Mechanism 104

Part

Specifications—Continued:

102 (102-39) Zero Fahrenheit Lubricating Oil 106
103 (103-39) 45 Degrees Below Zero Fahrenheit Lubricating Oil 107
104 (104-39) Air-Cooled Reactor for Line and Track Circuits 121
105 (105-39) Tractive Armature Direct Current Neutral Relay with Two or More Contact Fingers 123
106 (106-39) Resistor 135
107 (107-39) Switchboard 153
108 (10820) Copper Bond Wire 175
110 (11033) Wire Joints 179
111 (111-39) Mineral Matter Rubber Compound Insulated Wire 186
112 (112-39) Portable Alternating Current Ammeter 3
113 (113-39) Battery Jar (Primary) 9
114 (114-39) Mechanical Interlocking Machine, Style "A" Locking 83
115 (115-39) Portable Alternating Current Voltmeter 169
119 (119-39) Wiring 84
120 (120-39) Paint and Painting 110
121 (121-27) Compensation of Pipe Lines for the Operation of Mechanical Units 113
122 (122-39) One-Inch Welded Steel Pipe 114
123 (123-39) One-Inch Welded Wrought Iron Pipe 116
128 (128-39) Mechanical Time Release 129
130 (130-39) Circuit Controller for Drawbridges 48
134 (134-39) Electro-Mechanical Interlocking Machine 193
135 (135-39) Track Circuit Rail Bonding 22
137 (137-39) Oil Lighted Lamp 204
138 (138-39) Interlocking Lever Circuit Controller 197
140 (140-39) Preservative Treatment of Capping and Grooved Trunking 202
141 (141-34) Automatic Interlocking 208
144 (144-39) Dry Process Porcelain Insulation 80
145 (145-39) Parkway Cable—Mineral Matter Rubber Compound Insulated Wire 20
146 (146-39) Pin Type Porcelain Insulators 160
147 (147-35) Car Retarder System 27
148 (148-39) Alternating Current Power Transfer Relay 53
149 (149-37) Centralized Traffic Control System 97
150 (150-39) Centralized Traffic Control Machine 98
151 (151-39) Plug Type Rail Bonds and Track Circuit Connectors 112
152 (152-39) Electro-Pneumatic Switch Operating Mechanism 30
154 (154-39) Tractive Armature Direct Current Neutral Relay for Series Line Approach Lighting 101
155 (155-39) Railroad Highway Grade Crossing Signs 44
156 (156-39) Reflector Unit 43
157 (157-39) Electric Color Light Signal Operating Mechanism, Searchlight Type 93
158 (158-39) Lead Acid Stationary Storage Battery (Plates of Alloy Composition) 117
159 (159-39) Brass and High Tensile Strength Metals and Alloys for Binding Posts, Machine Screws, Nuts, Washers, etc., Used in Signal Apparatus 119
160 (160-39) Capacitor for Power Factor Correction 100
161 (161-39) Fibrous-Covered Non-Metallic Sheath for Railway Signal Cable 36
162 (162-39) Electric Color Position Light Signal 50
163 (163-39) Weatherproof Covering for Line Wire 46
165 (165-39) Tractive Armature Direct Current Polarized Relay 137
166 (166-39) Copper-Oxide Rectifiers and Valves 139

Part

Specifications—Continued:
- 167 (167-39) Bare Copper-Covered Steel Line Wire, Thirty Per Cent Conductivity 180
- 168 (168-39) Bare Copper Alloy Line Wire, Thirty Per Cent Conductivity 173
- 169 (169-39) Bare Hard-Drawn Copper Line Wire 182
- 170 (170-39) Air Depolarized Dry Cell 11
- 171 (171-39) Type "B" Copper-Oxide Caustic Soda Primary Cell 4
- 173 (173-39) Copper-Covered Steel Guy and Messenger Strand 69
- 174 (174-39) Electric Lamp Case 12
- 175 (175-38) Interlocking at Drawbridges for the Protection of Train Movements 64
- 176 (176-37) Highway Grade Crossing Signals 149
- 177 (177-39) Insulating Material for Filling and Sealing Recesses in Signal Apparatus 60
- 178 (178-39) Welded Type Rail Head Bonds and Track Circuit Connectors 141
- 179 (179-39) Mechanically Applied Rail Head Type Bonds and Track Circuit Connectors 142
- 180 (180-39) Centralized Traffic Control Detachable Type Neutral Direct Current Relay 145
- 181 (181-39) Paint and Painting of Braid-Covered Aerial Wires and Cables—Cable Paint—Volatile Thinner 151
- 182 (182-39) Weather-Resisting Braid Coverings for Aerial, Rubber-Insulated Wire and Cable 172
- 183 (183-39) Multiple Unit Terminal Block 155
- 185 (185-39) Flasher Relay 143
- 186 (186-39) Tractive Armature Direct Current Neutral Interlocking Relay 105
- 187 (187-39) Paint and Painting of Braid-Covered Aerial Wires and Cables—Cable Paint—Asphalt or Coal Tar Emulsion 152

Spring Switch Markers 77

Spring Switches:
- Conclusion and Findings 103
- Maintaining, Inspecting and Testing—Instructions 140
- Signal Protection for—Requisites 10

Standardization of Pipe Thread 115

Stationary Storage Battery, Lead Type:
- Plates of Alloy Composition Supporting Active Material in Paste Form—Specification 158 (158-39) 117
- Plates of Composite Structure Supporting Active Material in the Form of Pure Lead—Specification 53 (53-39) 18
- Plates of Pure Lead, Electro-Chemically Formed, in Combination with Plates of Alloy Supporting Active Material in Paste Form—Specification 58 (58-39) 19

Steel Bonding Wire:
- Copper-Covered, Forty Per Cent Conductivity—Specification 70 (70-39) 176
- Galvanized E.B.B.—Specification 22 (22-39) 177

Steel Guy and Messenger Strand:
- Copper-Covered—Specification 173 (173-39) 69
- Specification for 184

Steel, Iron or; Galvanizing for—Specification 29 (29-39) 63

Steel Line Wire:
- Bare Copper-Covered, Thirty Per Cent Conductivity—Specification 167 (167-39) 180
- Galvanized Copper Bearing; Specification for 181

Part

Steel Pipe:
  Conduit—Specification 36 (3613) 39
  One-Inch Welded—Specification 122 (122-39) 114
Steel Reinforced Aerial Aluminum Cable—Specification 54 (54-39) 24
Storage Battery:
  Lead Acid Stationary:
    Plates of Alloy Composition Supporting Active Material in Paste Form—Specification 158 (158-39) 117
    Plates of Composite Structure Supporting Active Material in the Form of Pure Lead—Specification 53 (53-39) 18
    Plates of Pure Lead, Electro-Chemically Formed, in Combination with Plates of Alloy Supporting Active Material in Paste Form—Specification 58 (58-39) 19
  Lead Acid Type, Electrolyte for; Specification for 13
  Lead Acid Type; Installation, Maintenance and Operation of—Instructions 14
  Lead Acid Type Report—A.A.R. Sig. Sec. 7056 14
  Nickel, Iron, Alkaline; Installation, Maintenance and Operation of—Instructions 16
  Nickel, Iron, Alkaline—Specification 49 (49-39) 15
Strand, Guy and Messenger:
  Bronze, Specification for 70
  Copper-Covered Steel—Specification 173 (173-39) 69
  Steel, Specification for 184
Stranded and Flexible Conductors, Wires Required for; Table of 189
Stringing Sags for New Line Wires 163
Style "A" Locking, Mechanical Interlocking Machine—Specification 114 (114-39) 83
Submarine Cable, Armored—Specification 90 (90-39) 26
Supply and Distribution Calculations, Power; Alternating Current 118
Switch Circuit Controller Shunting Circuit Resistance Test—A.R.A. Sig. Sec. 7002 195
Switch Circuit Controller, Universal—Specification 95 (95-39) 49
Switch Circuit Controllers, Inspecting, Testing and Maintaining—Instructions 134
Switch, Electric Motor; Operating Mechanism—Specification 101 (101-39) 104
Switch Indicators—Requisites 72
Switch Lamps, Signal and; Electric Lighting of—Conclusion and Findings 103
Switch Markers, Spring 77
Switch, Non-Interlocked; Take Siding Indicator and Leave Siding Indicator for—Requisites 71
Switch Operating Mechanism:
  Electric Motor—Specification 101 (101-39) 104
  Electro-Pneumatic—Specification 152 (152-39) 30
Switchboard—Specification 107 (107-39) 153
Switchboard, Installation and Operation of—Instructions 154
Switches, Remote; Signal Layout for 194
Switches, Spring:
  Conclusion and Findings 103
  Maintaining, Inspecting and Testing—Instructions 140
  Signal Protection for—Requisites 10
Symbols and Wire Nomenclature, Example of Application of 33
Tables:
  Life Hours for Lamps 120
  Minimum Allowable Resistance in Series with Track Battery for Standard or Conventional Direct Current Track Circuits 132

Part

Tables—Continued:
  Operating Characteristics:
    Model 2-A Signals 54
    Relays:
      Alternating Current 124
      Direct Current 126
    Searchlight, Color Light Signals 61
    Style L Signals 54
    Styles S and B Signals 54
    T-2 Signals 54
  Recommended Sags for Messenger Wires 185
  Signal and Interlocking Units 203
  Stringing Sags for New Line Wire 163
  Wires Required for Stranded and Flexible Conductors 189
Tag:
  Relay Record:
    A.C.—A.A.R. Sig. Sec. 7053 124
    D.C.—A.A.R. Sig. Sec. 7017 126
  Repair—A.A.R. Sig. Sec. 7018 124, 126
Take Siding Indicator and Leave Siding Indicator for Non-Interlocked Switch—Requisites 71
Tape:
  Friction; for Railroad Use—Specification 82 (8226) 157
  Rubber Insulating—Specification 56 (5632) 158
Technical Terms Used in Signaling—Definitions 55
Telegraph, Telephone and other Communication Wires and Cables Crossing the Tracks of Steam and Electrified Railroads, Specification for 192
Terminal Block, Multiple Unit—Specification 183 (183-39) 155
Terms Used in Signaling, Technical—Definitions 55
Test, Capacity; Nickel, Iron, Alkaline Storage Battery—A.A.R. Sig. Sec. 7001 16
Test, Electrical Torque, Shop and Field, of Motor Semaphore Signals; Methods of Making 54
Test Record of A.C. Electrical Apparatus:
  Daily Field—A.A.R. Sig. Sec. 7052 124
  Office—A.A.R. Sig. Sec. 7051 124
Test Record of D.C. Electrical Apparatus:
  Daily Field—A.A.R. Sig. Sec. 7016 126
  Office—A.A.R. Sig. Sec. 7015 126
Test Record, Track Circuit, D.C.—A.R.A. Sig. Sec. 7021 and 7022 131
Test, Resistance; Train Shunt—A.R.A. Sig. Sec. 7003 196
Test, Service, Motor Semaphore Signals; Method of Making 54
Test, Switch Circuit Controller Shunting Circuit Resistance—A.R.A. Sig. Sec. 7002 195
Testing—Instructions:
  Automatic Interlocking 59
  Car Retarder Systems 125
  Electric Lamps 120
  Electric Locking 199
  Insulated Rail Joints 133
  Interlocking Plants 138
  Light Signals 61
  Mechanical Locking of an Interlocking Machine 200
  Motor Semaphore Signals 54
  Relays, Alternating Current 124
  Relays, Direct Current 126
  Spring Switches 140
  Switch Circuit Controllers 134

Part
Tests, Torque, at the Semaphore Shaft of Motor Semaphore Signals; Method of Making 54
Thirty Per Cent Conductivity Bare Copper Alloy Line Wire—Specification 168 (168-39) 173
Thread, Pipe 115
Threads, Bolts, Nuts and; Specification for 17
Time Release, Mechanical—Specification 128 (128-39) 129
Time Releases Applied to Signal Apparatus, Setting of—Instructions 128
Tonnage or Grade Signals—Conclusion and Findings 103
Track Battery:
  And Track; Formulae for Computing Minimum Allowable Resistance between, and for Computing Related Current and Voltage Data 132
  Curves for Determining Minimum Allowable Resistance in Series with, for Various Train Shunt Resistances and Various Maximum Battery Terminal Voltages, for Standard or Conventional Track Circuits 132
  Minimum Allowable Resistance in Series with, for Standard or Conventional Direct Current Track Circuits; Tables of 132
Track Circuit Connectors and Plug Type Rail Bonds:
  Resistances of Single and Duplex Conductor—A.A.R. Sig. Sec. 7058 112
  Specification 151 (151-39) 112
Track Circuit Connectors, Rail Head Bonds and:
  Mechanically Applied Type—Specification 179 (179-39) 142
  Welded Type—Specification 178 (178-39) 141
Track Circuit Rail Bonding—Specification 135 (135-39) 22
Track Circuit Territory, Track Welding or Heat Treating in—Requisites 156
Track Circuits:
  Alternating Current, Maintenance and Operation of—Instructions 162
  Characteristics, A.C. 161
  Direct Current:
    Curves for Determining the Minimum Allowable Resistance in Series with Track Battery for Various Train Shunt Resistances and Various Maximum Battery Terminal Voltages, for Standard or Conventional Track Circuits 132
    Formula for Computing Minimum Allowable Resistance between Track Battery and Track 132
    Formula for Computing the Current Discharge from Battery with the Selected Train Shunt Resistance RS 132
    Formula for Computing the Maximum Battery Voltage EB when the Train Shunt Resistance and the Minimum Allowable Resistance in Series with Battery has been Selected 132
    Maintenance and Operation—Instructions 8
    Minimizing the Effect of Foreign Current on—Requisites 127
    Table I—Maximum Voltage at Battery Terminals for use with 2-Ohm Relay 132
    Table II—Maximum Voltage at Battery Terminals for use with 4-Ohm Relay 132
    Tables of Minimum Allowable Resistance in Series with Track Battery for Standard or Conventional Direct Current Track Circuits 132
    Test Record—A.R.A. Sig. Sec. 7021 and 7022 131
  Minimizing the Effect of Lightning on—Requisites 81
  Reactor, Air-Cooled; for Line and—Specification 104 (104-39) 121
Track, Single; Economical Train Performance on—Conclusion 103
Track, Track Battery and; Formulae for Computing Minimum Allowable Resistance between, and for Computing Related Current and Voltage Data 132
Track Welding or Heat Treating in Track Circuit Territory—Requisites 156

PRINTED IN U. S. A.

Part

Tractive Armature Direct Current Neutral Relay:
  Centralized Traffic Control Detachable Type—Specification 180 (180-39) 145
  For Series Line Approach Lighting—Specification 154 (154-39) 101
  Interlocking—Specification 186 (186-39) 105
  With Two or More Contact Fingers—Specification 105 (105-39) 123
Tractive Armature Direct Current Polarized Relay—Specification 165 (165-39) 137
Traffic at Movable Bridges, Requirements for the Protection of 23
Traffic Control, Centralized:
  Conclusion and Findings 103
  Machine—Specification 150 (150-39) 98
  Relay, Detachable Type Neutral Direct Current—Specification 180 (180-39) 145
  System:
    Requisites 86
    Specification 149 (149-37) 97
Traffic Railroads, Light, Crossing at Grade; Signal Protection for—Conclusion and Findings 103
Train Approach Signals 159
Train Control Expenditures; Guide for Allocating 74
Train Movements, Interlocking at Drawbridges for the Protection of—Specification 175 (175-38) 64
Train Operation by Signal Indication—Conclusion and Findings 103
Train Performance, Economical, on Single Track—Conclusion 103
Train Shunt Resistance Test—A.R.A. Sig. Sec. 7003 196
Train Shunt Resistances, Various, and Various Maximum Battery Terminal Voltages; Curves for Determining the Minimum Allowable Resistance in Series with Track Battery for, for Standard or Conventional Track Circuits 132
Transfer Relay, Power; Alternating Current—Specification 148 (148-39) 53
Transformer Oil—Specification 46 (46-39) 108
Transformers:
  Ail-Cooled—Specification 83 (83-39) 164
  Oil-Immersed, Self-Cooled—Specification 84 (84-39) 165
Treating, Heat; Track Welding or, in Track Circuit Territory—Requisites 156
Treatment of Capping and Grooved Trunking; Preservative—Specification 140 (140-39) 202
Treatment of Electrical Windings, Impregnating Compound—Requisites 171
Treatment of Electrical Windings, Varnish—Requisites 174
Trolley Lines Crossing Railways; Electric Light, Power Supply and; Railroad Specifications for 191
Trunking and Capping, Wood—Specification 57 (57-39) 167
Trunking, Grooved, Capping and; Preservative Treatment of—Specification 140 (140-39) 202
Turnouts and Crossovers; Fouling Protection—A.R.A. Sig. Sec. 7004 206
Type "A" Copper-Oxide Caustic Soda Primary Cell—Specification 87 (87-39) 6
Type "B" Copper-Oxide Caustic Soda Primary Cell—Specification 171 (171-39) 4
Type of Interlocking Which Should be Installed, Factors Which Govern in Determining the 198
Underground Conduit Construction, Communication; Specification for 38
Unit Distribution, Signal and Interlocking—A.A.R. Sig. Sec. 7050 203
Unit, Multiple, Terminal Block—Specification 183 (183-39) 155
Unit, Reflector—Specification 156 (156-39) 43

Part
Unit Value Basis, Example of Use of 203
Units, Signal and Interlocking; Table of 203
Universal Switch Circuit Controller—Specification 95 (95-39) 49
Use of Unit Value Basis, Example of 203
Value Basis, Unit; Example of Use of 203
Value of Signaling, Forecast of the—Form 24 29
Valves, Copper-Oxide Rectifiers and—Specification 166 (166-39) 139
Varnish Treatment of Electrical Windings—Requisites 174
Vibrating Highway Crossing Bell, Direct Current—Specification 44 (44-39) 21
Vitrified Clay Conduit, Specification for 41
Volatile Thinner Cable Paint—Paint and Painting of Braid-Covered Aerial Wires and Cables—Specification 181 (181-39) 151
Voltage Data, Computing Related Current and; Formulae for Computing Minimum Allowable Resistance between Track Battery and Track and for 132
Voltage EB, Maximum Battery, when Train Shunt Resistance and the Minimum Allowable Resistance in Series with Battery has been Selected; Formula for Computing the 132
Voltage Ranges for Signal Work 170
Voltages, Battery Terminal, Various Maximum; Curves for Determining Minimum Allowable Resistance in Series with Track Battery for Various Train Shunt Resistances and, for Standard or Conventional Track Circuits 132
Volt-Ammeters, Portable Direct Current—Specification 85 (85-39) 168
Voltmeter, Portable Alternating Current—Specification 115 (115-39) 169
Voltmeters, Portable Direct Current—Specification 85 (85-39) 168
Washers, Brass and High Tensile Strength Metals and Alloys for—Specification 159 (159-39) 119
Weatherproof Covering for Line Wire—Specification 163 (163-39) 46
Weather-Resisting Braid Coverings for Aerial, Rubber-Insulated Wire and Cable—Specification 182 (182-39) 172
Welded Steel Pipe, One-Inch—Specification 122 (122-39) 114
Welded Type Rail Head Bonds and Track Circuit Connectors—Specification 178 (178-39) 141
Welded Wrought Iron Pipe, One-Inch—Specification 123 (123-39) 116
Welding, Track, or Heat Treating in Track Circuit Territory—Requisites 156
Windings, Electrical:
  Impregnating Compound Treatment of—Requisites 171
  Varnish Treatment of—Requisites 174
Wire:
  Aerial, Rubber-Insulated Cable and; Weather-Resisting Braid Coverings for—Specification 182 (182-39) 172
  Bronze Guy and Messenger Strand, Specification for 70
  Copper Bond—Specification 108 (10820) 175
  Copper-Covered Steel Bonding, Forty Per Cent Conductivity—Specification 70 (70-39) 176
  Copper-Covered Steel Guy and Messenger Strand—Specification 173 (173-39) 69
  Enameled Round Copper Magnet; Specification for 183
  Galvanized E.B.B. Steel Bonding—Specification 22 (22-39) 177
  Inspection Report 178
  Joints—Specification 110 (11033) 179
  Line:
    Bare Copper Alloy, Thirty Per Cent Conductivity—Specification 168 (168-39) 173

Part

- Wire—Continued:
  - Line—Continued:
    - Bare Copper-Covered Steel, Thirty Per Cent Conductivity—Specification 167 (167-39) 180
    - Bare Hard-Drawn Copper—Specification 169 (169-39) 182
    - Steel, Galvanized Copper Bearing; Specification for 181
    - Stringing Sags for New 163
    - Weatherproof Covering for—Specification 163 (163-39) 46
  - Messenger; Recommended Sags for 185
  - Mineral Matter Rubber Compound Insulated—Specification 111 (111-39) 186
  - Nomenclature; Example of Application of Symbols and 33
  - Stranded and Flexible Conductors; Table of Wires Required for 189
- Wires and Cables, Aerial, Braid-Covered; Paint and Painting of:
  - Cable Paint—Asphalt or Coal Tar Emulsion—Specification 187 (187-39) 152
  - Cable Paint—Volatile Thinner—Specification 181 (181-39) 151
- Wires and Cables, Insulated; Handling—Instructions 190
- Wires and Cables, Telegraph, Telephone and other Communication, Crossing the Tracks of Steam and Electrified Railroads; Specification for 192
- Wiring—Specification 119 (119-39) 84
- Wood Trunking and Capping—Specification 57 (57-39) 167
- Written Circuits, Circuit Nomenclature and 33
- Wrought Iron:
  - Bars, Specification for 90
  - Pipe Conduit—Specification 37 (3713) 40
  - Pipe, One-Inch Welded—Specification 123 (123-39) 116
- Yards, Gravity Classification; Signaling for 42
- Zero Fahrenheit Lubricating Oil—Specification 102 (102-39) 106
- Zero, 45 Degrees Below, Fahrenheit; Lubricating Oil—Specification 103 (103-39) 107

A.A.R. SIGNAL SECTION SPECIFICATION 73-39.

ALTERNATING CURRENT GENERATOR

Official Approval

May 1920, Sept. 1932, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a synchronous alternating current generator, either single-phase or polyphase. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Contractor shall furnish with his tender, drawings forming an essential part thereof.

(b) Contractor shall furnish drawings or references showing the following information:

1. Outline drawing giving over-all dimensions, dimensions of shaft extension, and method of bringing out leads; also type and dimensions of conduit terminal box and exact location if furnished.
2. Foundation drawing giving size and exact location of anchor bolts.
3. Drawing or reference of rheostat, regulator, and other accessories, giving exact drilling dimensions, including diagrammatic sketch of connections.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

(b) Contractor shall furnish with his tender the following information:

1. Guaranteed temperature rise.
2. Efficiencies at power factor specified at ½, ¾ and full loads.
3. Voltage regulation at power factor specified.

PRINTED IN U. S. A.

4. *Alternates.*

(a) The provisions contained in alternate requisites section 7332 form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Generator shall conform to Contractor's drawings or references.

(b) Generator shall be of the revolving field type. *R-6-b.

(c) Generator shall be driven by a motor. *R-6-c.

(d) Generator shall be direct-connected. *R-6-d.

(e) Generator shall be equipped with direct-connected exciter. *R-6-e.

7. *Purchaser's order.*

(a) Purchaser's order shall specify the following requirements which shall be met:

1. Continuous output capacity in kv-a.
2. Full-load terminal voltage.
3. Frequency.
4. Number of phases.
5. Full-load amperes per terminal.
6. Per cent power factor.
7. Speed.
8. Any unusual atmospheric conditions.

8. *Doweling.*

(a) Adjoining portions of the generator, where efficiency and good operation are affected by alignment, shall be doweled or rabbeted together, dowels to be fitted to accurately reamed holes. Through dowels in all cases shall be provided with threads and a nut for withdrawal. Adjoining portions of the generator shall be given corresponding marks when desirable for securing correct assembly.

9. *Bearings.*

(a) All bearings shall have ample surface to insure cool running and shall be readily replaceable.

(b) Bearings shall be of sleeve type provided with babbitted or bronze linings and shall be self-oiling preferably by ring method. *R-9-b.

---

* Section 7332. Alternate requisites.

A.A.R. SIGNAL SECTION SPECIFICATION 112-39.

PORTABLE ALTERNATING CURRENT AMMETER

Official Approval
Nov. 1921, Dec. 1935, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a portable alternating current ammeter for testing electrical apparatus and circuits. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Design.*

(a) Instrument shall be of a design approved by the Purchaser.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

5. *General.*

(a) Instruments shall be made in 12 combinations:

1. Combinations Nos. 1-a, 2-a, 3-a, 4-a, 5-a, 6-a and 7-a for use when a relatively high degree of accuracy is desired.

2. Combinations Nos. 1-b, 2-b, 3-b, 4-b and 5-b for use when a less accurate instrument is desired.

6. *Ranges and scales.*

(a) Instruments shall be self-contained.

(b) Ranges and scales shall be as follows:

Combination No.	Amperes	Min. length of upper arc, in.	Divisions*	No. of blocks*	Divisions per block*
1 (a)	0– 0.150	5	150	15	10
(b)	0– 0.150	2½	75	7½	10
2 (a)	0– 0.500	5	100	10	10
(b)	0– 0.500	2½	50	5	10
3 (a)	0– 2.00	5	100	10	10
(b)	0– 2.00	2½	50	5	10
4 (a)	0– 5.00	5	100	10	10
(b)	0– 5.00	2½	50	5	10
5 (a)	0– 15.00	5	150	15	10
(b)	0– 15.00	2½	75	7½	10
6 (a)	0– 50.00	5	100	10	10
7 (a)	0–100.00	5	100	10	10

* Figures to apply as far as practicable.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 171-39.

TYPE "B" COPPER-OXIDE CAUSTIC SODA PRIMARY CELL

Official Approval
Aug. 1936, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a copper-oxide caustic soda (sodium hydroxide, NaOH) primary cell. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

5. *Designation.*

(a) The capacity shall be designated as follows:

1. Elements for use in jars, Drawing 1053, details 10532 and 10533, and Drawing 1419, detail 14192, shall be designated a cell of 500 ampere-hour capacity.

6. *Assembly.*

(a) Each complete cell, unless otherwise specified, shall consist of the following properly proportioned parts:

1. Positive and negative electrodes rigidly assembled, insulated and equipped with connecting wire and suspension bolt.
2. Caustic soda.
3. Battery oil.
4. Two washers.
5. Two wing nuts.
6. One hexagonal nut.
7. One porcelain cover.
8. One glass jar.

PRINTED IN U. S. A.

6. *Assembly*.—Continued.

(b) Each renewal shall include the following properly proportioned parts:

1. Positive and negative electrodes rigidly assembled, insulated and equipped with connecting wire and suspension bolt.
2. Caustic soda.
3. Battery oil.

(c) Each complete cell (jars excepted) and renewal shall be furnished in its entirety by one Manufacturer.

7. ***Elements.***

(a) Cathode.

1. It shall consist of copper oxide of quantity and quality to furnish a proper depolarization agent at all temperatures and discharge rates the cell is designed to meet, and shall be active for not less than 2 per cent in excess of the rated capacity of the cell.
2. Assembly connections shall be of low electrical resistance and free from harmful corrosive action.

(b) Anode.

1. It shall be basically of zinc of satisfactory quality properly amalgamated and of sufficient weight and texture to remain active for not less than 2 per cent in excess of the rated ampere-hour capacity specified.
2. It shall be so formed and amalgamated that at no time shall there be any tendency to flake or shed portions that may produce an internal short at discharge rates the cell is designed to meet.
3. It shall be so designed that there is a visible indication of approaching exhaustion, and a further visible indication when the rated ampere-hour capacity of the cell has been delivered.
4. Assembly connections shall be of low electrical resistance and free from harmful corrosive action.

8. *Electrolyte.*

(a) Electrolyte shall be a solution of sodium hydroxide. The caustic soda shall be of proper quality and in a form which will dissolve readily in water. Irrespective of particle size or shape, not more than 10 per cent by weight of the caustic soda as furnished shall pass a 100 mesh screen.

(b) The amount of caustic soda supplied shall be such that 2 per cent in excess of the rated capacity of the cell can be obtained at all discharge rates the cell is designed to meet and at solution temperatures between 25 and 90 deg. F.

(c) Caustic soda shall be delivered in a metal container, sealed and marked with Manufacturer's name, type and capacity of cell for which intended.

9. *Oil.*

(a) The correct amount of oil for each cell shall be supplied in a bottle securely sealed unless otherwise provided by Manufacturer.

(b) Oil supplied to cover the electrolyte shall be resistant to the action of caustic soda and shall flow freely at 25 deg. F. It shall have proper surface tension to prevent creeping salts.

10. *Jars.*

(a) Jars shall be in accordance with Specification 113.

11. *Wing nuts, bolts and washers.*

(a) Bolts shall conform to Drawing 1070.

(b) Wing nuts shall be made of cast brass and shall conform to Drawing 1053.

(c) Clamp nuts shall be made of brass and shall conform to Drawing 1070.

(d) Washers may be made of copper or brass and shall conform to Drawing 1070.

12. *Covers.*

(a) Covers shall be wet process porcelain and conform to Drawing 1053, detail 10537.

13. *Connections.*

(a) Wing nuts shall be provided for fastening external connections to positive post of battery.

(b) A negative connection of soft-drawn insulated copper wire not less than No. 12 A.W.G. and of sufficient length to extend not less than 11 in. above the cover shall be provided.

(c) Suspension bolt shall extend not less than 1⅛ in. and not more than 1½ in. above top of cover when element is tightened to cover.

14. *Inspection.*

(a) Purchaser may inspect material at all stages of manufacture.

(b) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(c) If material has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and the Contractor, upon request, shall advise the Purchaser what disposition is to be made of the rejected material. Contractor shall pay all freight charges.

(d) If Purchaser is to make inspection at point of production it shall be so stated.

PRINTED IN U. S. A.

29. *Signals.*

(a) Signals shall be of .... type.

(b) Semaphore signals shall have an arm travel of 90 deg. in the upper right-hand quadrant.

(c) Signals shall be in accordance with the following specifications and drawings, where applicable:

1. Electric Motor Semaphore Signal—Specification 79.
2. Electric Color Light Signal—Specification 80.
3. Electric Position Light Signal—Specification 81.
4. Electric Color Light Signal Operating Mechanism, Searchlight Type—Specification 157.
5. Electric Color Position Light Signal—Specification 162.
6. "U" Bolt and Clamp—Drawing 1083.
7. Filler Block—Drawings 1090, 1091 and 1092.
8. Ladders—Drawings 1365, 1366, 1583, 1619 and 1620.
9. Ladder Foundation—Drawing 1052.
10. Adapter-Base for Ground Mast Bottom Mechanism Signals—Drawing 1387.
11. Base for 4-Inch Mast—Drawing 1449.
12. Details and Assembly of Marker Lights—Drawing 1238.
13. Grade Signal Marker—Drawing 1612.
14. Take Siding Indicator—Dimensions and Lettering—Drawing 1551.

(d) Signals shall be aligned to give the best view to approaching trains.

30. *Circuits.*

(a) Purchaser will indicate which and to what extent circuits shall be single wire, single break, or double wire, double break, and furnish typical circuit plans which the Contractor will follow.

(b) Track circuits shall be continuous on all main tracks and fouling protection shall conform to Form 7004. *R-30-b.

(c) Direct current circuits shall be in accordance with Requisites for Automatic Block Signaling Circuits. *R-30-c.

(d) Installation and operation of track circuits shall be in accordance with A. C. Track Circuit Characteristics and Instructions for the Maintenance and Operation of Alternating Current Track Circuits, or Instructions for Maintenance and Operation of Direct Current Track Circuits.

(e) Contractor's recommended arrangement of switchboard circuits shall be followed, subject to modifications to meet Purchaser's special requirements.

---

* Alternate requisites section.

PRINTED IN U. S. A.

31. *Signal lighting.*

(a) Methods of signal lighting shall be:

1. ....
2. ....

32. *Wires and cables.*

(a) Wires and cables shall be in accordance with the following specifications (*R-32-a):

1. Specification for Galvanized Copper Bearing Steel Line Wire.
2. Specification for Steel Guy and Messenger Strand.
3. Bare Copper-Covered Steel Line Wire, Thirty Per Cent Conductivity—Specification 167.
4. Bare Copper Alloy Line Wire, Thirty Per Cent Conductivity—Specification 168.
5. Bare Hard-Drawn Copper Line Wire—Specification 169.
6. Weatherproof Covering for Line Wire—Specification 163.
7. Mineral Matter Rubber Compound Insulated Wire—Specification 111.
8. Aerial Aluminum Cable Steel Reinforced—Specification 54.
9. Aerial Braided Cable—Specification 89.
10. Armored Submarine Cable—Specification 90.
11. Lead-Covered Cable—Specification 91.
12. Parkway Cable—Specification 145.
13. Fibrous-Covered Non-Metallic Sheath for Railway Signal Cable—Specification 161.
14. ....
15. ....

33. *Size of wire.*

(a) Wire shall be of sufficient size to permit operation of signal mechanisms in accordance with this specification.

(b) Single-conductor wires shall be not smaller than No. 16 A.W.G.

(c) Wires in cable shall be not smaller than No. 14 A.W.G. *R-33-c.

(d) Line wires shall be not smaller than No. 10 A.W.G. for hard-drawn copper or No. 12 A.W.G. for copper-covered steel. *R-33-d.

(e) Common wire shall have conductivity of not less than that of No. 10 A.W.G. for hard-drawn copper.

(f) Spare wires in cable shall be provided as follows:

1. ....
2. ....

---

* Alternate requisites section.

PRINTED IN U. S. A.

37. *Bonding.*

(a) Bonds shall be .... type and bonding installed in accordance with Specification 135.

38. *Batteries.*

(a) Batteries shall be in accordance with the following specifications and drawings:

1. Nickel, Iron, Alkaline Storage Battery—Specification 49.
2. Lead Acid Stationary Storage Battery (Plates of Pure Lead)—Specification 58.
3. Lead Type Portable Storage Battery for Signaling—Specification ...., dated ....
4. Lead Acid Stationary Storage Battery (Plates of Alloy Composition)—Specification 158.
5. Lead Acid Stationary Storage Battery (Plates of Composite Structure)—Specification 53.
6. Specification for Electrolyte.
7. Type "A" Copper-Oxide Caustic Soda Primary Cell—Specification 87.
8. Type "B" Copper-Oxide Caustic Soda Primary Cell—Specification 171.
9. Battery Jar (Primary)—Specification 113.
10. Battery Jar (Storage)—Specification ...., dated ....
11. Round Jars and Cover—Drawing 1053.
12. Rectangular Jars and Cover—Drawing 1419.

(b) Jars for caustic soda type of battery shall conform to Drawing ...., dated ....

(c) Track batteries shall be .... type and .... a.h. capacity.

(d) Line batteries shall be .... type and .... a.h. capacity.

(e) Operating batteries shall be .... type and .... a.h. capacity.

39. *Relays.*

(a) Direct current relays.

1. Tractive armature direct current neutral relays shall be in accordance with Specifications 105 and 154.

   (a) Track relays shall be of .... ohms resistance and have not more than .... nor less than .... contact fingers.

   (b) Line relays shall be of .... ohms resistance and have not more than .... nor less than .... contact fingers.

2. Tractive armature direct current polarized relays shall be in accordance with Specification 165.

A.A.R. SIGNAL SECTION SPECIFICATION 87-39.

TYPE "A" COPPER-OXIDE CAUSTIC SODA PRIMARY CELL

Official Approval
Mar. 1921, Aug. 1936, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a copper-oxide caustic soda (sodium hydroxide, NaOH) primary cell. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

5. *Designation.*

(a) The capacity shall be designated as follows:

1. Elements for use in jars, Drawing 1418, detail 14182, shall be designated a cell of 250 ampere-hour capacity as indicated in Table I, Class 1.

2. Elements for use in jars, Drawing 1053, details 10532 and 10533, and Drawing 1419, detail 14192, shall be designated a cell of 500 ampere-hour capacity as indicated in Table I, Classes 2, 3 and 4.

3. Elements for use in jars, Drawing 1053, detail 10535, and Drawing 1419, detail 14191, shall be designated a cell of 1000 ampere-hour capacity as indicated in Table I, Classes 5 and 6.

6. *Assembly.*

(a) Each complete cell, unless otherwise specified, shall consist of the following properly proportioned parts:

1. Positive and negative electrodes rigidly assembled, insulated and equipped with connecting wire and suspension bolt.

6. *Assembly*.—Continued.

2. Caustic soda.
3. Battery oil.
4. Two washers.
5. Two wing nuts.
6. One hexagonal nut.
7. One porcelain cover.
8. One glass jar.

(b) Each renewal shall include the following properly proportioned parts:

1. Positive and negative electrodes rigidly assembled, insulated and equipped with connecting wire and suspension bolt.

2. Caustic soda.
3. Battery oil.

(c) Each complete cell (jars excepted) and renewal shall be furnished in its entirety by one Manufacturer.

7. *Elements*.

(a) Cathode.

1. It shall consist of copper oxide of quantity and quality to furnish a proper depolarization agent at all temperatures and discharge rates the cell is designed to meet, and to be active for not less than 2 per cent in excess of the rated capacity of the cell.

2. Assembly connections shall be of low electrical resistance and free from harmful corrosive action.

(b) Anode.

1. It shall be basically of zinc of satisfactory quality properly amalgamated and of sufficient weight and texture to remain active for not less than 2 per cent in excess of the rated ampere-hour capacity specified.

2. It shall be so formed and amalgamated that at no time shall there be any tendency to flake or shed portions that may produce an internal short at discharge rates the cell is designed to meet.

3. It shall be so designed that there is a visible indication of approaching exhaustion, and a further visible indication when the rated ampere-hour capacity of the cell has been delivered.

4. Assembly connections shall be of low electrical resistance and free from harmful corrosive action.

8. *Electrolyte.*

(a) Electrolyte shall be a solution of sodium hydroxide. The caustic soda shall be of proper quality and in a form which will dissolve readily in water. Irrespective of particle size or shape, not more than 10 per cent by weight of the caustic soda as furnished shall pass a 100 mesh screen.

(b) The amount of caustic soda supplied shall be such that 2 per cent in excess of the rated capacity of the cell can be obtained at all discharge rates the cell is designed to meet and at solution temperatures between 25 and 90 deg. F.

(c) Caustic soda shall be delivered in a metal container, sealed and marked with Manufacturer's name, type and capacity of cell for which intended.

9. *Oil.*

(a) The correct amount of oil for each cell shall be supplied in a bottle securely sealed unless otherwise provided by Manufacturer.

(b) Oil supplied to cover the electrolyte shall be resistant to the action of caustic soda and shall flow freely at 25 deg. F. It shall have proper surface tension to prevent creeping salts.

10. *Jars.*

(a) Jars shall be in accordance with Specification 113.

11. *Wing nuts, bolts and washers.*

(a) Bolts shall conform to Drawing 1070.

(b) Wing nuts shall be made of cast brass and shall conform to Drawing 1053.

(c) Clamp nuts shall be made of brass and shall conform to Drawing 1070.

(d) Washers may be made of copper or brass and shall conform to Drawing 1070.

12. *Covers.*

(a) Covers shall be wet process porcelain and conform to Drawing 1053, detail 10537, Drawing 1418, detail 14183, or Drawing 1419, detail 14193.

13. *Connections.*

(a) Wing nuts shall be provided for fastening external connections to positive post of battery.

(b) A negative connection of soft-drawn insulated copper wire not less than No. 12 A.W.G. and of sufficient length to extend not less than 11 in. above the cover shall be provided.

(c) Suspension bolt shall extend not less than 1⅛ in. and not more than 1½ in. above top of cover when element is tightened to cover.

14. *Inspection.*

(a) Purchaser may inspect material at all stages of manufacture.

(b) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(c) If material has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and the Contractor, upon request, shall advise the Purchaser what disposition is to be made of the rejected material. Contractor shall pay all freight charges.

(d) If Purchaser is to make inspection at point of production it shall be so stated.

15. *Tests.*

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Contractor shall give the Purchaser sufficient notice of time when material will be ready for testing.

(c) Contractor shall provide, at point of production, apparatus and labor for making required tests under supervision of the Purchaser.

(d) If tests are to be made at point of production, the Purchaser shall so state and also indicate which of the tests herein specified are to be made and what portion of the material shall be tested.

(e) Cells shall be selected at random by picking out not more than 10 nor less than 2 from each 1000 cells for each test.

(f) Cells shall be assembled, set up, handled, and, where necessary, renewed strictly in accordance with Manufacturer's standard instructions.

(g) Tests shall be made at varying solution temperatures in a range between 25 and 90 deg. F.

(h) Meters and thermometers shall be in proper calibration.

(i) Voltage readings shall be taken across the terminals of the cells and corrections made for resistance of meter leads.

(j) Resistances shall be adjusted as necessary to maintain the desired discharge rates within 2 per cent.

(k) Electrolyte temperature shall be measured at a point approximately 3 in. below the surface of the electrolyte and approximately 1 in. from the inside wall of the jar.

(l) Cells shall be tested in jars having a total capacity (plus or minus 2 per cent) as follows:

Ampere-hour capacity	Cubic centimeters
250	3410
500	5150
1000	9100

15. *Tests.*—Continued.

(m) In all cases distilled water or water without injurious impurities shall be used.

(n) Cells to be tested shall be so arranged that solution temperatures in the range between 25 and 90 deg. F. may be obtained without the necessity of moving cells at any time during test.

(o) At no time during the test shall there be any agitation or stirring of the electrolyte.

(p) Elements shall have a normal appearance during the entire test, and the electrolyte shall remain sufficiently clear to allow inspection of the element. The solution shall not show crystallization.

16. *Capacity test.*

(a) Cells shall be tested for capacity and low temperature performance by being placed on a continuous discharge at rates and duration shown in Table I. Voltages shall be as shown in Table I. During period of temperature changes, current shall be adjusted to 0.1 ampere.

(b) The period of time between temperature changes shall be not less than 8 hours nor more than 16 hours.

(c) Cells tested under the specification for comparative results shall be tested concurrently and under like conditions as to solution temperatures.

17. *Packing.*

(a) Material shall be so prepared as to permit convenient handling and to protect against loss or damage during shipment.

18. *Marking.*

(a) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of package.

(b) Detail list of loose pieces, containers and their contents shall be furnished for each shipment. Where carload shipments are made, routing and car identification shall be shown.

(c) Where carload shipments are made, name and address of Consignee may be omitted.

19. *Warranty.*

(a) Contractor shall warrant the material covered by this specification to be free from defects in material and workmanship under ordinary use and service, his obligation under this warranty being limited to manufacturing, at point of production, any part or parts to replace those which shall be found defective within one year after shipment to the Purchaser. This warranty shall not apply to any material which has been subjected to misuse, negligence or accident.

TABLE I

Complete cycle of test—At all hourly periods shown voltage shall be not less than 0.50.

Capacities:	250 Ampere Hours	500 Ampere Hours			1000 Ampere Hours	
Class:	1	2	3	4	5	6
Discharge rates:	7 amperes	2 amperes	2 amperes	6 amperes	4 amperes	6 amperes
Hours of discharge. Initial step with temperature range 80±10 deg. F.	1	1	1	1	1	1
	4	25	25	25	25	25
	8	49	49	49	49	49
	24	73	73	73	73	73
	*32.15	97	97	*75	97	97
		121	121		121	121
		145	145		145	145
		169	169		169	*150
		193	193		193	
		217	217		217	
		*225	*225		*225	

Capacities:	250 Ampere Hours	500 Ampere Hours			1000 Ampere Hours	
Class:	1	2	3	4	5	6
Discharge rates:	3.25 amperes	0.8 ampere	1 ampere	3 amperes	1.5 amperes	4 amperes
Hours of discharge. Intermediate step with temperature range 27±2 deg. F.	0.25	0.25	0.25	0.25	0.25	0.25
	0.50	0.50	0.50	0.50	0.50	0.50
	1.00	1.00	1.00	1.00	1.00	0.75
	1.25	2.00	2.00	1.50	1.50	1.00
		3.00	3.00		2.00	
		4.00	4.00		2.60	
		5.00				

Capacities:	250 Ampere Hours	500 Ampere Hours			1000 Ampere Hours	
Class:	1	2	3	4	5	6
Discharge rates:	7 amperes	1 ampere	2 amperes	6 amperes	3 amperes	6 amperes
Hours of discharge. Final step with temperature range 80±10 deg. F.	1	1	1	1	1.0	1
	2	2	5	3	5.0	5
	**3	10	20	5	20.0	13
		40	21	6	30.0	14
		42	22	**7.5	31.0	15
		**46	**23		**32.0	**16

Notes:

Test to be continued to determine that 2 per cent excess capacity is available at a voltage of not less than 0.50.

Ampere hours discharge during temperature changes shall be computed and be included in ampere hours.

*Check should be made to note that indication of approaching exhaustion is apparent at this point.

**Check should be made to note that indication of rated capacity has been reached at this point.

A.A.R. SIGNAL SECTION SPECIFICATION 113-39.

BATTERY JAR

Official Approval
July 1928, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a primary battery jar. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Drawing 1053, 1418 or 1419 forms an essential part hereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

(b) Manufacturer's identification mark shall be blown on side of each jar.

(c) Variations shall be within the limits specified on Drawing 1053, 1418 or 1419.

5. *Inspection.*

(a) Purchaser may inspect material at all stages of manufacture.

(b) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(c) If material has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected and the Contractor, upon request, shall advise the Purchaser what disposition is to be made of the rejected material. Contractor shall pay all freight charges.

(d) If Purchaser is to make inspection at point of production it shall be so stated.

6. *Tests.*

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Contractor shall give the Purchaser sufficient notice of time when material will be ready for testing.

PRINTED IN U. S. A.

6. *Tests.*—Continued.

(c) Contractor shall provide, at point of production, apparatus and labor for making required tests under supervision of the Purchaser.

(d) If tests are to be made at point of production, the Purchaser shall so state and also indicate which of the tests herein specified are to be made and what portion of the material shall be tested.

(e) Purchaser shall select from the proposed shipment either 4 or 20 jars for the heating and chilling test and one for the solubility test.

(f) Breakage for each test shall not exceed one when 4 jars are tested or 2 when 20 jars are tested.

7. *Solubility.*

(a) Expose 110 sq. in. of inside of jar surface by filling to the required level with a solution consisting of 20 grams NaOH (caustic soda) by titration in 100 c.c. of distilled water, then place in oven maintained at 120 deg. F. for 100 hours. The jar shall not show a loss of weight in excess of 0.5 gram.

8. *Heating test.*

(a) Jars having a specified wall thickness of 3/16 in., placed 1/3 their depth in a mixture of crushed ice or snow and salt at 5 deg. F. for 10 minutes, shall not check or crack due to being half filled with paraffin at 375 deg. F. Temperature shall be read with bulb of thermometer in ice and against bottom edge of jar. Jars having a specified wall thickness of 1/4 in. shall withstand a similar test with a paraffin temperature of 340 deg. F.

9. *Chilling test.*

(a) Jars having a specified wall thickness of 3/16 in., maintained at a temperature of 225 deg. F. for 30 minutes, either in an oven or in a boiling saturated salt solution, shall not check or crack due to being thrust bottom downward in a tub of ice water at 40 deg. F. and then tipped over and allowed to fill. Jars having a specified wall thickness of 1/4 in. shall withstand a similar test at a temperature of 212 deg. F.

PRINTED IN U. S. A.

10. *Packing.*

(a) Material shall be so prepared as to permit convenient handling and to protect against loss or damage during shipment.

(b) Jars shall be furnished in multiples of the contents of a standard package. When not so ordered, the Manufacturer may correct the order to the nearest standard package quantity.

(c) Standard package for jars in accordance with Drawing 1053, details 10532, 10533 and 10534, and Drawing 1419, detail 14192, shall hold 8 jars.

(d) Standard package for jars as shown on Drawing 1053, detail 10535, and Drawing 1419, detail 14191, shall hold 4 jars.

(e) Standard package for jars in accordance with Drawing 1418, detail 14182, shall hold 16 jars.

11. *Marking.*

(a) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of package.

(b) Detail list of loose pieces, containers and their contents shall be furnished for each shipment. Where carload shipments are made, routing and car identification shall be shown.

(c) Where carload shipments are made, name and address of Consignee may be omitted.

12. *Warranty.*

(a) Contractor shall warrant the material covered by this specification to be free from defects in material and workmanship under ordinary use and service, his obligation under this warranty being limited to manufacturing, at point of production, any part or parts to replace those which shall be found defective within one year after shipment to the Purchaser. This warranty shall not apply to any apparatus which has been subjected to misuse, negligence or accident.

A.A.R. SIGNAL SECTION SPECIFICATION 170-39.

AIR DEPOLARIZED DRY CELL

Official Approval

Aug. 1936, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing an air depolarized dry cell. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

3. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

(b) Anode, basically of zinc, shall be smooth, free from flaws, blisters and cracks.

(c) Cathode, basically of carbon, shall be free from defects detrimental to the service life of the cell.

(d) Electrolyte, basically of sal ammoniac, shall be mixed with a suitable moisture-retaining filler.

(e) Sealing compound shall be an insulating material which shall not flow at a temperature of 113 deg. F. during a static test of 24 hours duration.

(f) Cell shall be enclosed in a close-fitting container of an insulating material which shall be moisture resistant.

(g) Terminals shall be of brass (8-32 thread) with knurled nut and shall not be obstructed by the container, solder, or protruding material of the seal, and shall be securely attached to the electrodes.

4. *Dimensions.*

(a) Cell shall not exceed over-all dimensions shown for the various capacities:

Ampere-hour capacity	Length, in.	Width, in.	Height, in.	Maximum weight, lb.
120	4¼	2¼	7½	3½
135	3½	3½	7½	3½
250	4¼	4¼	7½	6½
500	6¼	6¼	8	13¼

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 174-39.

ELECTRIC LAMP CASE

Official Approval

Aug. 1938, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a lamp case for electric lamp used with reflector for semaphore signal lighting. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Drawing 1446 forms an essential part hereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *General requirements.*

(a) Each lamp case shall be equipped with a reflector and a 5⅜ in. clear roundel. *R-6-a.

(b) Each lamp case shall be provided with a candelabra bayonet socket for lamps having a light center length of 1¼ in., a single contact base and S-11 bulb. The socket shall be adjusted by the Manufacturer to such a position that an accurately based lamp when placed in the socket will have its filament at the focal point of the reflector.

(c) Binding posts, conforming to Drawing 1070, detail 10705, shall be provided for wire terminals. They shall be so mounted that they cannot turn in the base or frame to which they are fastened.

---

* Alternate requisites section.

A.A.R. SIGNAL SECTION SPECIFICATION 49-39.

NICKEL, IRON, ALKALINE STORAGE BATTERY

Official Approval
Sept. 1934, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a complete storage battery, cells and sets. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

3. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

(b) The capacity shall be designated as "40 A.H.," "80 A.H.," "120 A.H.," "160 A.H.," "200 A.H.," "320 A.H." and "400 A.H." These terms shall be understood to signify on an 8-hour basis the capacities thus designated in this specification.

(c) Each cell, unless otherwise specified, shall include the following parts:

1. One group of positive plates.
2. One group of negative plates.
3. One set of terminals and copper connecting straps fitted to pole pieces.
4. One set of hard rubber separators and insulators.
5. One container.
6. Electrolyte of caustic potash and lithia.

4. *Elements.*

(a) Positive plates shall be tubes of perforated sheet steel, nickel-plated, filled with alternate thin layers of nickel hydrate (active material) and flakes of pure metallic nickel. The tubes are mounted in nickel-plated steel frames or grids.

(b) Negative plates shall be thin rectangular pockets of perforated sheet steel, nickel-plated, filled with iron oxide (active material) and mounted in nickel-plated steel grids.

(c) The terminal shall extend through cover and shall be

A.A.R. SIGNAL SECTION SPECIFICATION 53-39.

LEAD ACID STATIONARY STORAGE BATTERY

Plates of Composite Structure Supporting Active Material In the Form of Pure Lead

Official Approval
July 1928, Sept. 1934, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a composite plate type stationary storage battery cell in sealed-in glass jar. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

3. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

(b) The capacity shall be designated as "40 A.H.," "60 A.H.," "80 A.H.," "120 A.H.," "160 A.H.," "200 A.H.," "240 A.H.," "280 A.H.," "320 A.H." and "400 A.H." These terms shall be understood to signify on an 8-hour basis the capacities thus designated in this specification.

(c) Each cell, unless otherwise specified, shall include the following parts:

1. One positive group consisting of the necessary number of plates assembled with connecting strap and pillar post.
2. One negative group consisting of the necessary number of plates assembled with connecting strap and pillar post.
3. One connecting bolt for each pillar post bolt hole.
4. One set of separators consisting of one wood separator and the necessary dowels between each positive and negative plate.
5. One inter-cell connector.
6. One jar with sealed cover and vent plug.
7. Necessary electrolyte.

4. *Elements.*

(a) Positive plates shall consist of a pure lead-antimony alloy grid securely supporting cylindrical forms of pure lead and shall have the active material electro-chemically formed.

(b) Negative plates shall be made with the active material enclosed in a pure lead-antimony alloy frame with finely perforated sides. End plates shall be of the same thickness as the intermediate plates.

4. *Elements.*—Continued.

(c) Plates shall be connected into positive and negative groups by securely burning to lead-antimony alloy connecting straps, which shall be cast in one piece with the pillar post.

(d) Pillar post shall extend through cover and shall be fastened thereto. An effective seal to retard seepage of electrolyte shall be provided between cover and pillar post.

5. *Separators.*

(a) Separators shall be of such quality, material and design as to avoid the necessity of replacement during the guaranteed life of the elements.

(b) Separators shall be made of specially selected tough, acid-resisting porous wood and treated so that all injurious substances are removed; each separator to have a minimum of three hard rubber dowels.

(c) Separators shall be so designed as to permit free circulation of the electrolyte between the plates.

(d) Separators shall be of sufficient size to extend beyond the perimeter of the plates and shall be supported in a substantial manner so as to remain in place.

6. *Jars.*

(a) Jars shall be of glass, rectangular, free from flaws of a detrimental nature, properly annealed and of a design that permits the application of a cover properly sealed thereto.

(b) Jars shall be of size and shape so that the over-all dimensions of the cell (including terminal posts) for capacities indicated, shall not exceed the following:

Ampere-hour capacity	Length, in.	Width, in.	Height, in. (including posts)
40	4 11/16	8 1/16	14 3/8
60*	4 11/16	8 1/16	14 3/8
60	5 15/16	8 1/16	14 3/8
80–9 plate*	5 15/16	8 1/16	14 3/8
80–5 plate	5 3/4	10 3/4	17 3/8
80–9 plate	7	8 1/16	14 3/8
120	6 5/8	10 3/4	17 3/8
160	8 1/8	10 3/4	17 3/8
200	9 3/4	10 3/4	17 3/8
240	11	10 3/4	17 3/8
280	12 5/8	10 3/4	17 3/8
320	9 1/4	14 7/32	22
400	10 11/16	14 7/32	22

---

* To be used where housing space is not available for the conventional sizes.

6. *Jars.*—Continued.

(c) Jars shall be so constructed on the bottom that they will rest evenly on a horizontal plane without rocking.

(d) A line shall be provided on the jars to indicate the proper level of the electrolyte.

(e) Jars shall be of such quality and thickness as to provide an excess of strength necessary to support the elements and withstand ordinary handling.

7. *Covers.*

(a) Covers shall be made of insulating material designed to prevent sagging and shall be free from circuit leakage, impurities detrimental to the plates or separators, and impervious to absorption of electrolyte.

(b) Covers shall be so designed as to provide for an effective seal between cover and jar by the application of suitable sealing compound, and shall be free from rough edges.

8. *Vent plugs.*

(a) A suitable filling hole shall be located in the cover and shall be provided with a removable screw or bayonet type plug so vented that gas will readily escape without carrying entrained electrolyte.

(b) Vent plugs shall be of such design that permits ready removal and replacement, and not easily displaced in shipping or handling.

9. *Connectors.*

(a) Inter-cell connectors shall be flexible, corrosion resisting, and free from soldered or sweated joints.

(b) Inter-cell connectors shall have a carrying capacity for 8-hour discharge rate without heating or offering abnormal resistance at any discharge rate the cell is designed to deliver.

10. *Sealing compound.*

(a) Sealing compound shall be of acid-proof material which will readily adhere to the glass jar and shall contain no ingredients injurious to the cell.

(b) Sealing compound shall be such that it will not crack in service at 25 deg. F. below zero nor be soft enough to run at 150 deg. F.

PRINTED IN U. S. A.

11. *Electrolyte.*

(a) Electrolyte shall be dilute sulphuric acid, 1.200 to 1.220 specific gravity, and shall be in accordance with Specification for Electrolyte.

12. *Assembly and charge.*

(a) Cell shall be completely assembled, sealed and charged ready for service.

(b) A metal plate of suitable size shall be permanently and uniformly secured to the cover of each cell, upon which shall be legibly impressed information as to type, capacity and date of shipment.

13. *Inspection.*

(a) Purchaser may inspect material at all stages of manufacture.

(b) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(c) If material has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and the Contractor, upon request, shall advise the Purchaser what disposition is to be made of the rejected material. Contractor shall pay all freight charges.

(d) If Purchaser is to make inspection at point of production it shall be so stated.

14. *Tests.*

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Contractor shall give the Purchaser sufficient notice of time when material will be ready for testing.

(c) Contractor shall provide, at point of production, apparatus and labor for making required tests under supervision of the Purchaser.

(d) If tests are to be made at point of production, the Purchaser shall so state and also indicate which of the tests herein specified are to be made and what portion of the material shall be tested.

(e) The following test shall be made at the option of the Purchaser on 10 per cent of the number of cells ordered. The cells shall be selected by the Purchaser from the proposed shipment and shall, after being fully charged, be discharged and charged as follows:

14. *Tests.*—Continued.

	A.H.	A.H.	A.H.	A.H.	A.H.	A.H.	A.H.	A.H.	A.H.	A.H.
1. Normal capacity	40	60	80	120	160	200	240	280	320	400
2. Discharge for 8-hour rate	5	7.5	10	15	20	25	30	35	40	50

3. Discharge at 8-hour rate to minimum final voltage of 1.75 volts per cell.

4. Charge at 8-hour rate for a period 20 per cent longer than the duration of the previous discharge.

5. After charging, again discharge at 8-hour rate to a minimum final voltage of 1.75 volts per cell.

6. Recharge at 8-hour rate for a period 20 per cent longer than the duration of the previous discharge.

7. Electrolyte temperature at beginning of discharge shall be 80 deg. F. maximum with ambient temperature from 5 to 10 deg. F. lower and held within these limits during the test discharge.

8. During each charge and discharge the current shall be held constant at the value specified.

9. Cells shall show 85 per cent or more of their rated capacity under this test.

10. The voltage on discharge shall be measured while current is flowing.

15. *Packing.*

(a) Material shall be so prepared as to permit convenient handling and to protect against loss or damage during shipment.

16. *Marking.*

(a) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of package.

(b) Detail list of loose pieces, containers and their contents shall be furnished for each shipment. Where carload shipments are made, routing and car identification shall be shown.

(c) Where carload shipments are made, name and address of Consignee may be omitted.

17. *Warranty.*

(a) Contractor will be obligated to furnish an adjustment policy corresponding to the type of service intended, which shall be a minimum of 6 years in cycle duty and a minimum of 14 years in floating service. If the battery at any time cannot be made to give 80 per cent capacity the Manufacturer is further

17. *Warranty*.—Continued.

obligated to either replace or repair the battery, the expense of either the replacement or repair to be reduced in proportion to the life received from the original battery.

(b) Contractor shall warrant the material covered by this specification to be free from defects in material and workmanship under ordinary use and service, his obligation under this warranty being limited to manufacturing, at point of production, any part or parts to replace those which shall be found defective within one year after shipment to the Purchaser. This warranty shall not apply to any material which shall have been repaired or altered in any way by anyone other than the Manufacturer thereof, so as to affect, in the Contractor's judgment, its proper functioning or reliability, or which has been subject to misuse, negligence or accident.

A.A.R. SIGNAL SECTION SPECIFICATION 58-39.

LEAD ACID STATIONARY STORAGE BATTERY

Plates of Pure Lead, Electro-Chemically Formed, in Combination with Plates of Alloy Supporting Active Material in Paste Form

Official Approval

July 1928, Sept. 1934, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a combination plate type of stationary lead storage battery cell in sealed-in glass jar. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

3. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

(b) The capacity shall be designated as "40 A.H.," "60 A.H.," "80 A.H.," "120 A.H.," "160 A.H.," "200 A.H.," "320 A.H." and "400 A.H." These terms shall be understood to signify on an 8-hour basis the capacities thus designated in this specification.

(c) Each cell, unless otherwise specified, shall include the following parts:

1. One positive group consisting of the necessary number of plates assembled with connecting strap and pillar post.
2. One negative group consisting of the necessary number of plates assembled with connecting strap and pillar post.
3. One connecting bolt for each pillar post bolt hole.
4. One set of separators consisting of one wood separator and the necessary dowels between each positive and negative plate.
5. One inter-cell connector.
6. One jar with sealed cover and vent plug.
7. Necessary electrolyte.

A.A.R. SIGNAL SECTION SPECIFICATION 145-39.

PARKWAY CABLE

Mineral Matter Rubber Compound Insulated Wire

Official Approval
July 1929, Sept. 1932, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing parkway cable containing mineral matter rubber compound insulated wire for 660 volts or less. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Alternates.*

(a) The provisions contained in alternate requisites section 14532 form a part hereof only when substituted for the provisions contained in this specification.

3. *General.*

(a) Cable bought under this specification will be used for .... current at .... volts and shall be .... ft. in length.

4. *Cable.*

(a) Cable shall consist of .... conductors insulated with rubber compound and laid into cable with paraffined jute laterals to make round. The assembly shall be taped and over the core thus formed a lead sheath shall be placed. Over the lead sheath shall be laid a layer of impregnated jute bedding, then two overlapping layers of steel tape. An outside layer of impregnated jute covering shall be laid over the tape. *R-4-a.

5. *Conductors.*

(a) Number and size of conductors in cable shall be as follows:

Number of conductors	Circular mils or A.W.G. of conductors	Number of wires each conductor
....	....	....
....	....	....

---

* Section 14532. Alternate requisites.

A.A.R. SIGNAL SECTION SPECIFICATION 44-39.

DIRECT CURRENT VIBRATING HIGHWAY CROSSING BELL

Official Approval
July 1927, Dec. 1935, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a vibrating bell, operated by direct current, for protection of highway traffic crossing railroads at grade. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *General design.*

(a) Bell shall be of the gong type, 12 inches in diameter. *R-6-a.

(b) Bell shall be designed to be attached to the top of a standard 4 in. pipe post. *R-6-b.

(c) Suitable wire entrance shall be provided.

(d) Moving parts, except hammer, shall be enclosed in a weatherproof case.

(e) Like parts of same Manufacturer's bell shall be interchangeable.

---

* Alternate requisites section.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 135-39.

TRACK CIRCUIT RAIL BONDING

Official Approval

July 1924, July 1930, Aug. 1938, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing bonding of railway signaling track circuits where rails do not carry return propulsion current. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material and workmanship meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *General.*

(a) Rail joints shall be bonded with bonds as specified by Purchaser.

(b) Switch point heel joints shall be bonded with bonds as specified by Purchaser.

(c) Rail joints in tunnels shall be bonded with bonds as specified by Purchaser.

(d) Rail joints in road crossings or platforms where planking or paving is maintained, or where bonding is inaccessible or in multiple shunt circuits, shall be double bonded.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 54-39.

AERIAL ALUMINUM CABLE STEEL REINFORCED

Official Approval

Sept. 1934, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing aerial aluminum cable steel reinforced of stated sizes. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Conductor.*

(a) Conductor shall be a cable composed of one solid galvanized steel core wire and six solid aluminum wires concentrically laid around it.

(b) Wires composing the cable shall be cylindrical in form, free from scales, flaws, splits and all imperfections.

(c) Each aluminum wire shall be smooth and true and vary not more than 1 per cent from the specified diameter. It shall not contain a splice of any kind within 50 ft. of another splice when extended full length. Its conductivity shall be not less than 60 per cent of International Annealed Copper Standard.

(d) There shall be no weld splice or joint in the steel core wire.

(e) Galvanizing shall be in accordance with Specification 29.

3. *Properties.*

(a) Mechanical properties of the separate wires and of the finished cable shall be in accordance with the following requirements:

1. Finished cable.

Nominal size A.W.G.	Diameter, in.	Circular mils	Elastic limit, lb.	Breaking strength, lb.	Approx. weight per 1,000 ft., lb.	Ohms per mile at 77 deg. F.
4/0	0.563	246,876	5,940	8,435	293.4	0.441
3/0	0.502	195,685	4,690	6,660	232.4	0.556
2/0	0.447	155,407	3,730	5,300	184.5	0.702
1/0	0.398	123,263	2,960	4,200	146.4	0.885
1	0.355	97,797	2,355	3,340	116.1	1.12
2	0.316	77,469	1,860	2,640	92.1	1.41
3	0.281	61,453	1,480	2,100	73.0	1.77
4	0.250	48,685	1,170	1,665	57.9	2.24
6	0.198	30,583	735	1,045	36.4	3.56

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 89-39.

AERIAL BRAIDED CABLE

Mineral Matter Rubber Compound Insulated Wire

Official Approval

March 1921, July 1930, Sept. 1932, Sept. 1933, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing aerial braided cable containing mineral matter rubber compound insulated wire for 660 volts or less. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *General.*

(a) Cable bought under this specification will be used for .... current at .... volts and shall be .... ft. in length.

3. *Cable.*

(a) Cable shall consist of .... conductors insulated with rubber compound and laid into cable with paraffined jute laterals to make round. The assembly shall be taped and over the core thus formed shall be wrapped with a closely woven braid.

4. *Conductors.*

(a) Number and size of conductors in cable shall be as follows:

Number of conductors	Circular mils or A.W.G. of conductors	Number of wires each conductor
....	....	....
....	....	....

(b) Conductors must be soft-drawn, annealed copper wire having a conductivity of not less than 98 per cent of that of the International Annealed Copper Standard. Each wire forming a conductor must be continuous without weld, splice or joint throughout its length, must be uniform in cross-section, free from flaws, scales and other imperfections and provided with a heavy uniform coating of tin.

5. *Taping, filling and braiding.*

(a) The core of the cable must be made cylindrical in form and properly laid up with one wire in each layer taped for a tracer. Cables of more than three and less

A.A.R. SIGNAL SECTION SPECIFICATION 90-39.

ARMORED SUBMARINE CABLE

Mineral Matter Rubber Compound Insulated Wire

Official Approval

March 1921, Sept. 1931, Sept. 1932, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing armored submarine cable containing mineral matter rubber compound insulated wire for 660 volts or less and for 2300 volts or less. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *General.*

(a) Cable bought under this specification will be used under water for .... current at .... volts and shall be .... ft. in length.

3. *Cable.*

(a) Cable shall consist of .... conductors insulated with rubber compound and laid into cable with paraffined jute laterals to make round. The assembly shall be taped and over the core thus formed a lead sheath shall be placed. Over the sheath shall be placed a jute covering with armoring over the jute. The armoring shall be covered by a layer of jute.

4. *Conductors.*

(a) Number and size of conductors in cable shall be as follows:

Number of conductors	Circular mils or A.W.G. of conductors	Number of wires each conductor
....	....	....
....	....	....

(b) Conductors shall be soft-drawn, annealed copper wire having a conductivity of not less than 98 per cent of that of the International Annealed Copper Standard. Each wire forming a conductor shall be continuous without undrawn brazes, welds, splices or joints throughout its length, shall be of uniform circular cross-section, free from flaws, scales and other imperfections and provided with a heavy uniform coating of tin. Stranded conductors shall be made concentric lay.

42. *Detector track circuits.*

(a) Track circuits shall be provided as shown on Drawing ...., dated ...., *R-42-a.

(b) Track circuits shall be direct current and shall conform to Drawing 1639. *R-42-b.

43. *Switchboard circuits.*

(a) Contractor's recommended arrangement of circuits shall be followed, subject to modification to meet Purchaser's special requirements.

44. *Electric lighting circuits.*

(a) Circuits for electric lights shall conform to plan submitted by the Purchaser.

(b) The maximum allowable drop in potential on electric lighting circuits from switchboard to any lamp shall be 10 per cent.

(c) Alternating current at .... volts, ... cycles distribution and .... volts, ... watt lamps shall be used. *R-44-c.

45. *Special circuits.*

(a) The special circuit requirements, in detail, are as follows:

1. ....
2. ....

46. *Wires and cables.*

(a) Wires and cables shall be in accordance with the following specifications:

1. Specification for Galvanized Copper Bearing Steel Line Wire.
2. Specification for Steel Guy and Messenger Strand.
3. Bare Copper-Covered Steel Line Wire, Thirty Per Cent Conductivity—Specification 167.
4. Bare Hard-Drawn Copper Line Wire—Specification 169.
5. Mineral Matter Rubber Compound Insulated Wire—Specification 111.
6. Aerial Aluminum Cable Steel Reinforced—Specification 54.
7. Aerial Braided Cable—Specification 89.
8. Lead-Covered Cable—Specification 91.
9. Armored Submarine Cable—Specification 90.
10. Parkway Cable—Specification 145.

---

* Alternate requisites section.

Alternate requisites.—Continued.

R-31-m.

Switch repeating and indicator lights shall not be provided.

R-31-n.

Contact springs shall be made of ....

R-31-r.

Materials used for impregnation shall be in accordance with Requisites for Impregnating Compound Treatment of Electrical Windings. / .... Enameling shall be in accordance with Specification for Enameled Round Copper Magnet Wire. / ....

R-32-k.

Electric lamps for indicators shall be .... filament for normal operation at .... volts with .... base and .... bulb.

R-37-g.

Retarder shoes shall be made of ....

R-42-a.

Track circuits shall not be provided.

R-42-b.

Track circuits shall be:

1. Alternating current.
2. Alternating current rectified.

R-44-c.

Direct current at .... volts distribution and .... volts, ... watt lamps shall be used.

R-47-d.

Line wires shall be ....

R-49-d.

Fuses shall be installed as follows: ....
....

R-54-j.

Not less than .... per cent of the capacity of the groove shall remain free for the installation of additional wires.

A.A.R. SIGNAL SECTION SPECIFICATION 91-39.

LEAD-COVERED CABLE

Mineral Matter Rubber Compound Insulated Wire

Official Approval

March 1921, Sept. 1931, Sept. 1932, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing lead-covered cable containing mineral matter rubber compound insulated wire for 660 volts or less and for 2300 volts or less. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *General.*

(a) Cable bought under this specification will be used for .... current at .... volts and shall be .... ft. in length.

3. *Cable.*

(a) Cable shall consist of .... conductors insulated with rubber compound and laid into cable with paraffined jute laterals to make round. The assembly shall be taped and over the core thus formed a lead sheath shall be placed.

4. *Conductors.*

(a) Number and size of conductors in cable shall be as follows:

Number of conductors	Circular mils or A.W.G. of conductors	Number of wires each conductor
....	....	....
....	....	....

(b) Conductors shall be soft-drawn, annealed copper wire having a conductivity of not less than 98 per cent of that of the International Annealed Copper Standard. Each wire forming a conductor shall be continuous without undrawn brazes, welds, splices or joints throughout its length, shall be of uniform circular cross-section, free from flaws, scales and other imperfections and provided with a heavy uniform coating of tin. Stranded conductors shall be made concentric lay.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 152-39.

ELECTRO-PNEUMATIC SWITCH OPERATING MECHANISM

Official Approval

Sept. 1932, Aug. 1936, Aug. 1938, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a pneumatically driven mechanism or dual-control mechanism (power or hand-operated) for first and second voltage ranges for operating and locking switches, derails and movable point frogs. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanhip shall be first-class in every respect.

6. *Power operating requirements.*

(a) Mechanism shall perform its operation in the following sequence:

1. Unlock switch, operate detector bar one-half stroke when bar is used.
2. Operate switch.
3. Lock switch, operate detector bar one-half stroke when bar is used.
4. Indicate.

(b) Mechanism shall be so designed that it can be stopped, reversed, or obstructed at any point of its movement without damage.

(c) Mechanism shall be so designed that it will follow the movement of the controller at the point of control.

6. *Power operating requirements.*—Continued.

(d) Mechanism shall be so designed that it will operate the switch points to the full normal or full reversed position and lock the points in these positions.

(e) Mechanism shall be so designed that it will hold switch points in locked position in the event of failure of air supply.

(f) Mechanism in locked position shall be capable of withstanding stress equivalent to a thrust of 20,000 lbs. either on the switch operating or locking connection.

(g) The cylinder shall be capable of delivering, without injury to the mechanism, the thrust corresponding to the overload curve shown on Drawing 1457.

(h) Circuit controlling device shall be so designed that its operation will be dependent upon and follow the movement of the mechanism and that the indicating circuits will not be energized until the mechanism has completed its operation.

(i) Circuit controlling device shall be so designed that the air pressure will be automatically restored to the cylinder in event of the switch becoming partially unlocked.

(j) Point detector shall be dependent upon and follow the movement of the switch points and shall lock the indication and "SS" circuits open should the switch points be forced open ⅜ in. when points are locked either in the normal or reversed position.

(k) Normal operating air pressure shall be 60 lbs. per sq. in.; the time of operation with this pressure at the cylinder with an operating thrust corresponding to curve shown on Drawing 1457 shall not exceed 2 seconds, nor shall it exceed 3 seconds at a pressure 10 per cent below normal. *R-6-k.

(l) Means shall be provided to either regulate the air supply or restrict the exhaust at each switch to insure correct speed of operation.

7. *Hand throw operating requirements.*

(a) To change from power to hand throw operating conditions, the selector lever shall perform the following functions in the sequence herein stated:

1. Shut off air supply to, and exhaust pressure from, the switch mechanism cylinders and open circuits for control of signals governing movements over routes involved.
2. Engage hand throw mechanism.

(b) Mechanism shall be so designed that the switch points are moved to the full normal or full reversed position before the hand throw lever can be latched in its position corresponding to the position of the switch.

---

* Alternate requisites section.

PRINTED IN U. S. A.

7. *Hand throw operating requirements.*—Continued.

(c) To change from hand throw to power operating conditions, the selector lever shall perform the following functions in the sequence herein stated:

1. Disengage hand throw operating mechanism.
2. Restore air supply and close control circuits for signals governing over the routes involved.

8. *Design.*

(a) Mechanism.

1. Mechanism and circuit controlling devices shall be enclosed in a substantial metallic weatherproof case, designed for mounting on two tie supports. The covers of the case shall be removable and when open shall permit access to all parts. Covers over circuit controlling devices shall be equipped with suitable fastenings for the application of Purchaser's padlock.

2. Mechanism and case shall be so designed that lock rod may be readily removed. Ends of plunger or locking dogs and holes or notches in lock rod shall have square edges. Such holes or notches shall be not more than ⅛ in. wider than the plunger.

3. Mechanism case shall be provided with wire entrance of ample size, conveniently located for access to binding posts, equipped with adapter castings and flexible metallic connections, and arranged to protect wires from mechanical injury. *R-8-a-3.

4. Mechanism shall be designed to permit dual-control operation. *R-8-a-4.

5. Mechanism and case shall be so designed that they will be applicable for right or left-hand operation and be interchangeable in the field.

6. Mechanism and case shall be so designed that the alignment of the lock and operating connections and the location and kind of fastening to switch ties shall conform to switch layout drawings. Operating rod shall have a maximum stroke of 6 in. *R-8-a-6.

7. Mechanism shall be designed for operation of auxiliary connection, Drawing ...., dated ...., and arranged so that when connection is not used it may be removed.

8. Mechanisms shall be so designed that all unused openings shall be securely closed, and that the used open-

---

* Alternate requisites section.

8. *Design.*—Continued.

ings be provided with suitable hoods to prevent snow interference.

9. Circuit controlling device and point detector shall be housed in separate compartments of the mechanism case, which compartments shall, so far as practicable, be non-sweating and dust-proof and have a separate metallic cover.

10. Point detector shall be provided with contacts required to control switch indicating relay.

11. Contact members shall be made of corrosion-resisting metal of sufficient mechanical strength and current-carrying capacity to satisfactorily operate in connection with the circuits used.

12. Movement of the contact members shall be such as will insure a wiping contact.

(b) Pneumatic cylinder.

1. The cylinder shall be attached to, and form a part of, the mechanism, and be removable therefrom.

2. Pipe entrance shall be of ample size and conveniently located for external connections.

(c) Electro-pneumatic valve.

1. Electro-pneumatic valve shall be enclosed in a substantial metallic ventilated weatherproof case designed for mounting independent of the switch mechanism, the covering of which case shall be removable and equipped with suitable fastenings for application of Purchaser's padlock, and when open shall permit access to all parts.

2. Case shall be provided with wire entrance of ample size conveniently located for access to binding posts, equipped with adapter castings and flexible metallic connections and arranged to protect wires from mechanical injury. *R-8-c-2.

3. Circuit controlling device shall be provided to be actuated by and form an integral part of the valve to insure that the switch point, valve and lever must coincide in position before indication is received. *R-8-c-3.

4. A cut-off feature shall be incorporated so as to provide for shutting off air supply and exhausting air from cylinder after the indication has been accepted.

5. Air strainer of sufficient size to insure an adequate air supply shall be incorporated in the body of the valve and shall be easily removed for cleaning.

---

* Alternate requisites section.

8. *Design.*—Continued.

6. Pipe entrance shall be of ample size and conveniently located for external connections.

7. Each valve magnet shall be enclosed in a metallic shell.

8. Magnets shall be designed for operation at .... volts d.c. or .... volts, ... cycles a.c.

9. Magnets shall operate satisfactorily when the voltage is reduced 20 per cent below rated voltage.

(d) Lubrication.

1. Provision shall be made for convenient lubrication of mechanism.

2. Exposed oil holes shall be provided with weather-proof oil cups, covers or approved fittings for pressure lubrication. Fittings for pressure lubrication shall be provided where practicable. *R-8-d-2.

(e) Clearance.

1. Apparatus, when installed, shall conform to clearance diagram recommended by the A.A.R.

9. *Wiring.*

(a) Internal wiring shall be neatly arranged and placed in ducts or channels of ample capacity forming an integral part of the apparatus.

(b) Wire for internal wiring shall be insulated and of strands of tinned or leaded copper not larger than No. 27 A.W.G. wire. The aggregate cross-section of the strands shall be not less than No. 14 A.W.G. wire. Wire eyelet shall be provided at each end.

(c) Wiring diagram shall be provided in the mechanism case and secured in such a manner as not to interfere with operation.

10. *Binding posts.*

(a) Binding posts, nuts and washers shall conform to detail 107010, Drawing 1070. *R-10-a.

(b) Material for binding posts shall be brass and shall meet the physical requirements shown on Drawing 1070. *R-10-b.

(c) Material for nuts shall be brass and shall meet the requirements shown on Drawing 1070. *R-10-c.

(d) Material for washers shall be brass and shall meet the requirements shown on Drawing 1070. *R-10-d.

(e) Binding posts shall be mounted so they cannot be turned in the base or frame to which applied, properly insulated.

(f) Binding posts shall be spaced not less than 1 in. centers.

(g) Binding posts for external wires shall, so far as practicable, be located adjacent to wire inlet, and duct spaces provided.

---

* Alternate requisites section.

11. *Finish.*

(a) Metal parts, except where parts used are inherently resistant to corrosion, shall be protected against corrosion except where such protection will interfere with the proper functioning of that part.

(b) Material used for protection against corrosion shall neither soften nor flake under ordinary conditions between temperatures of 40 deg. F. below zero and 185 deg. F. above zero.

12. *Paint and painting.*

(a) Paint and painting shall be in accordance with Specification 120.

13. *Insulation.*

(a) Wire for coils shall be soft-drawn copper-covered with good quality silk, cotton or enameled insulation in accordance with Specification for Enameled Round Copper Magnet Wire, or with equally good insulation.

(b) Coils shall be impregnated or otherwise treated so as to satisfactorily protect the wire from moisture under all service conditions.

(c) Impregnating compound treatment, when used, shall be in accordance with Requisites for Impregnating Compound Treatment of Electrical Windings.

(d) A.C. valve magnet coils shall not be impregnated.

14. *Dielectric requirements.*

(a) Electrical apparatus assembled shall withstand for one minute an insulation test, at place of manufacture, of 3000 volts a.c. between all parts of electric circuits and other metallic parts insulated therefrom.

(b) A surface leakage distance of not less than ¼ in. shall be provided between any exposed metallic part of the apparatus carrying current and any other metallic part thereof.

(c) Separate windings, which are insulated from each other, shall withstand for one minute an insulation test of 3000 volts a.c. between their terminals.

(d) A potential of twice the normal operating requirements at a suitable frequency shall be impressed across the windings without any excessive flow of current indicating a short circuit.

15. *Identification.*

(a) Mechanism shall be plainly marked with Manufacturer's references.

(b) Magnet coils and resistors shall be plainly marked with Manufacturer's references.

16. *Inspection.*

(a) Purchaser may inspect material at all stages of manufacture.

(b) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(c) If material has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and the Contractor, upon request, shall advise the Purchaser what disposition is to be made of the rejected material. Contractor shall pay all freight charges.

(d) If Purchaser is to make inspection at point of production it shall be so stated.

17. *Tests.*

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Contractor shall give the Purchaser sufficient notice of time when material will be ready for testing.

(c) Contractor shall provide, at point of production, apparatus and labor for making required tests under supervision of the Purchaser.

(d) If tests are to be made at point of production, the Purchaser shall so state and also indicate which of the tests herein specified are to be made and what portion of the material shall be tested.

18. *Packing.*

(a) Material shall be so prepared as to permit convenient handling and to protect against loss or damage during shipment.

19. *Marking.*

(a) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of package.

(b) Detail list of loose pieces, containers and their contents shall be furnished for each shipment. Where carload shipments are made, routing and car identification shall be shown.

(c) Where carload shipments are made, name and address of Consignee may be omitted.

20. *Warranty.*

(a) Contractor shall warrant the material covered by this specification to be free from defects in material and workmanship under ordinary use and service, his obligation under this warranty being limited to manufacturing, at point of production, any part or parts to replace those which shall be found defective within one year after shipment to the Purchaser. This

20. *Warranty.*—Continued.

warranty shall not apply to any apparatus which shall have been repaired or altered in any way by anyone other than the Manufacturer thereof, so as to affect, in the Contractor's judgment, its proper functioning or reliability, or which has been subject to misuse, negligence or accident.

Alternate requisites.

R-6-k.

The time of operation with 60 lbs. pressure per sq. in. shall not exceed .... seconds nor shall it exceed .... seconds at a pressure 10 per cent below normal.

R-8-a-3.

Mechanism case shall be provided with cable entrance.

R-8-a-4.

Dual-control mechanism shall not be furnished.

R-8-a-6.

Operating rod shall have a maximum stroke of .... in.

R-8-c-2.

Case shall be provided with cable entrance.

R-8-c-3.

Circuit controlling device shall not be provided as an integral part of the valve.

R-8-d-2.

Fittings for pressure lubrication shall not be provided.

R-10-a.

1. Binding posts, nuts and washers shall conform to detail 10705, Drawing 1070.
2. Binding posts, nuts and washers shall conform to detail 107015, Drawing 1070.

PRINTED IN U. S. A.

Alternate requisites.—Continued.

R-10-b.

1. Material for binding posts shall be copper base alloy, high strength, and shall meet the physical requirements shown on Drawing 1070.

2. Material for binding posts shall be nickel base alloy and shall meet the physical requirements shown on Drawing 1070.

R-10-c.

1. Material for nuts shall be copper base alloy and shall meet the requirements shown on Drawing 1070.

2. Material for nuts shall be nickel base alloy and shall meet the requirements shown on Drawing 1070.

R-10-d.

1. Material for washers shall be copper base alloy and shall meet the requirements shown on Drawing 1070.

2. Material for washers shall be nickel base alloy and shall meet the requirements shown on Drawing 1070.

SPECIFICATION FOR NO. 6 DRY CELL

1939

Official Approval

July 1937, July 1939.

The recommended specification for a cylindrical dry cell, designated as No. 6, general purpose and industrial types, for ignition and railway signal service, shall meet the current Specifications for Dry Cells and Batteries of the American Standards Association.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 23-39.

CHANNEL PINS

Official Approval

July 1930, July 1937, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing tin-plated single groove $\frac{9}{32}$ in. and double groove $\frac{3}{8}$ in. channel pins for fastening bond wires or rail connections into the rail. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Drawing 1086 forms an essential part hereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Dimensions of pins shall conform to Drawing 1086.

(b) Pins shall be made of steel containing not less than 0.05 per cent nor more than 0.12 per cent of combined carbon.

(c) Pins shall withstand being driven entirely through a hole of $\frac{9}{32}$ in. diameter for single groove or $\frac{3}{8}$ in. diameter for double groove, drilled in a piece of steel plate $\frac{9}{16}$ in. thick, without showing a flaw or crack of any kind. In addition, the pins, after being driven in the steel plate half the length of the pin, shall withstand bending at the large end 90 deg. flat on the plate sidewise to the groove without cracking or showing a fracture of any kind.

A.A.R. SIGNAL SECTION REQUISITES.

AUTOMATIC GATES
HIGHWAY CROSSINGS AT GRADE OVER RAILWAY TRACKS

1939

Official Approval

July 1939.

1. Automatic gates, where installed, shall be provided as an adjunct to A.A.R. recommended automatic crossing signals of the flashing light or wigwag type.

2. Automatic gates for the protection of highway traffic at a railroad grade crossing shall, when indicating the approach of a train, present toward the highway the appearance of a horizontal arm extending over the traveled roadway a sufficient distance to cover the lane or lanes used by traffic approaching the crossing.

3. The automatic gate arms when not indicating the approach of a train shall not obstruct or interfere with highway traffic.

4. A highway crossing bell, if used, shall sound a warning while the gate is being lowered.

5. The automatic gate arms shall be mounted on posts or housings containing the arm operating mechanisms.

6. The design of the gate operating mechanism shall, as far as practicable, be such as to insure proper operation during unfavorable weather conditions, and if out of order, the gate arms shall assume the horizontal position across the roadway.

7. The mechanisms shall be so designed that if the arms, while being raised or lowered, strike or foul an object, they will readily stop and, on removal of the obstruction, shall assume the position corresponding with the control apparatus.

8. Circuits for operation of the automatic gates shall be so arranged that gates will start to assume the horizontal position between 3 and 5 seconds after the warning signals start to operate. Gates shall reach full horizontal position before the arrival of the fastest train operated over the crossing and shall remain down until the rear of the train has cleared the crossing.

9. Each gate arm extending over the roadway shall have three red lights shining in both directions along the highway. The light nearest the tip of each arm shall burn steadily and the other two lights on each arm shall flash alternately.

10. The bottom of gate arms, when in the horizontal position, shall be not less than 3, nor more than 4 ft. above the crown of the roadway.

11. The gate arms shall be painted on both sides with alternate diagonal stripes of white and black.

PRINTED IN U. S. A.

12. The automatic highway crossing signals shall operate in accordance with A.A.R. recommended practice and independently of the gates.

13. Details of the signals, gates, operating mechanisms, and control circuits shall be in accordance with A.A.R. recommended practice.

14. The gate arms shall operate uniformly, smoothly, and complete all movements without rebound or slap, and be securely held when in the raised position.

15. Each individual gate post shall be provided with independent operating mechanism, and housing to be of sufficient size to allow ready inspection, adjustment and repairs.

16. The highway traffic lanes in the vicinity of the crossing shall be distinctly marked.

A.A.R. SIGNAL SECTION SPECIFICATION 161-39.

FIBROUS-COVERED NON-METALLIC SHEATH FOR RAILWAY SIGNAL CABLE

Official Approval
July 1937, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing non-metallic sheath and for performance tests applicable to non-metallic armored cable, for direct earth installation and installation in ducts; or, in combination with earth and duct installations, as aerial cable; designed to operate on railway signal circuits at potentials not exceeding 660 volts. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Sizes and multiples.*

(a) The non-metallic sheath provided for in this specification is for single-conductor cable, sizes 10 to 1/0 A.W.G., and multi-conductor cable, sizes 14 to 1/0 A.W.G.; the properties being in accordance with those contained in Specification 111.

3. *Non-metallic sheath.*

(a) General.

1. The non-metallic sheath shall provide protection against mechanical injury and the entrance of moisture, earth acids and alkalies, and provide a finished cable which meets the performance tests in this specification.

2. The protective non-metallic sheath shall consist of fibrous or composition tapes or jacket, mineral or vegetable fibre braids or servings, or combinations of these.

(b) Outer sisal braid.

1. The final layer of the sheath shall be a sisal braid, saturated with a preservative compound.

2. The saturated sisal braid shall be finished with a dark colored flexible coating compound such as stearine pitch, or high softening point asphalt, and coated with mica flake. The adjacent turns of the finished cable shall not adhere to each other.

(c) Thicknesses.

1. The thickness of the outer sisal braid shall be not less than 70 mils (0.070 in.).

2. The total thickness of the sheath shall be not less than shown in the following table:

Core diameter	Minimum total thickness of sheath
Up to 0.700 in.	0.160 in.
0.701 in. to 1.050 in.	0.190 in.
1.051 in. and larger	0.205 in.

PRINTED IN U. S. A.

5. *Pipe conduit fittings.*—Continued.

(c) Couplings shall be made of $\left\{\begin{array}{l}\text{steel,}\\ \text{malleable iron,}\end{array}\right\}$ shall conform to Briggs' Standard and shall be coated similar to the pipe.

(d) Malleable couplings shall be free from blow holes and shall have smooth interior surfaces.

6. *Tests.*

(a) Tensile strength, limit of elasticity and ductility shall be determined from a test piece cut from the finished pipe.

(b) Pipe shall have a tensile strength of not less than fifty-two thousand (52,000) pounds per square inch, and an elastic limit of not less than thirty thousand (30,000) pounds per square inch, and an elongation of not less than eighteen (18) per cent in a measured length of eight (8) inches. Pipe must stand a test of seven hundred (700) pounds per square inch internal hydrostatic pressure without leak in sizes up to two (2) inches in diameter and eight hundred (800) pounds in sizes of two and one-half (2½) to three (3) inches and one thousand (1000) pounds from three and one-half (3½) inches to seven (7) inches.

(c) One sample of pipe, twelve (12) inches in length, will be selected at random and subjected to a flattening test by hammering it until the opposite sides are within twice the thickness of the wall of each other. The piece shall show no cracks in the steel except at the weld.

(d) Galvanizing by the hot process shall conform to tests given in Specification 29.

(e) Galvanizing by the electro-plating process shall conform to a two (2) dip test given in Specification 29.

(f) Coating by the sherardizing process shall conform to tests given in Specification 29.

(g) Enamel.—The enamel shall be applied in an even, smooth coating not less than five thousandths (.005) inch thickness. It shall be of sufficient elasticity to prevent flaking and shall adhere on the smooth surface

Conduit,
Pipe,
Wrought Iron
Specification.
1913.

5-b. *Pipe conduit fittings.*—Continued.

I. P. S. Inches	Radius to center of pipe Inches	To fit in rectangle with sides Inches
½	4½	7½ x 10½
¾	5⅜	10 x 13
1	5¾	10⅛ x 13½
1¼	6¾	11½ x 15
1½	8¼	12⅝ x 16
2	9½	15¼ x 19
2½	10½	17¾ x 21
3	13	19⅜ x 23
3½	15	21 x 24
4	16	22½ x 26

(c) Couplings shall be made of wrought iron, shall conform to Briggs' Standard and shall be coated similar to the pipe.

6. *Tests.*

(a) Tensile strength, limit of elasticity and ductility and weld shall be determined from a test piece cut from the finished pipe.

(b) Pipe shall have a tensile strength of not less than forty thousand (40,000) pounds nor more than forty-eight thousand (48,000) pounds per square inch, and an elastic limit of not less than twenty-two thousand (22,000) pounds nor more than thirty thousand (30,000) pounds per square inch, and an elongation of not less than twelve (12) per cent in a measured length of eight (8) inches. The finished pipe must stand a hydrostatic test as follows: Up to two (2) inches, seven hundred fifty (750) pounds; two (2) to eight (8) inches, one thousand (1,000) pounds.

(c) A test ring with the length three (3) times the thickness of the pipe cut circumferentially is to be crushed down at the weld until the opposite sides are within three (3) times the thickness of the wall of each other. It is not expected that the wrought iron will stand this test without fracture, but the breaks must not be short or crystaline, or show evidence of defective material or bad welding, but must in every case show a fibrous formation in the iron.

(d) Galvanizing by the hot process shall be in accordance with Specification 29.

6. *Tests.*—Continued.

(e) Galvanizing by the electro-plating process shall conform to a two (2) dip test of Specification 29.

(f) Coating by the sherardizing process shall be in accordance with Specification 29.

(g) Enamel.—The enamel shall be applied in an even, smooth coating, not less than five thousandths (.005) inch thickness. It shall be of sufficient elasticity to prevent flaking and shall adhere on the smooth surface when the conduit is bent at normal temperature in a curve, the inner surface of which has a radius of ten (10) times the normal I. P. S. for all sizes. The enamel shall not be affected by moisture or heat at a temperature of one hundred (100) degrees C. Sample of the enameled conduit shall not be injuriously affected by an immersion for twenty-four (24) hours in a thirty (30) per cent (specific gravity 1.250) solution of sulphuric acid, or a thirty (30) per cent (specific gravity 1.125) solution of nitric acid or a thirty (30) per cent (specific gravity 1.050) solution of hydrochloric acid. When the conduit is both galvanized and enameled on the inside the acid tests will not be applied on the interior.

(h) Conduit furnished under this specification shall be inspected, approved and labled under supervision of the Underwriters Laboratories, Incorporated.

7. *Shipment and marking.*

(a) Threaded ends shall be protected in such manner as to prevent damage in transit.

(b) Conduit shipped in less than carload lots shall have name of the Manufacturer, Purchaser's order and inspection number, and shipping address plainly marked on a tag securely fastened to ten (10) per cent of the pieces in the shipment.

8. *Acceptance.*

(a) The Manufacturer shall provide, at his works, if required by Purchaser, all apparatus and other facilities needed for making the required tests, and shall give the Purchaser's representative an opportunity to test at all necessary times. Tests may also be made after delivery, and conduit will be rejected if it fails to meet the requirements of this specification. The Manufacturer shall pay all freight charges on rejected conduit.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 156-39.

REFLECTOR UNIT

Official Approval

Sept. 1933, July 1937, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a reflector unit for reflector signs for railroad highway grade crossing protection. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

3. *Type.*

(a) Reflector units may be of the double or the single refraction type and may be so designed as to enter the aperture in the face of sign either from the front or from the rear.

4. *Purchaser's order.*

(a) Purchaser's order shall state which type of reflector unit is to be furnished.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Reflector unit.*

(a) The reflector unit shall be of substantial design, accurately formed and constructed for correct focus.

1. When the reflector unit is of the double refraction type the reflector shall be accurately fitted to the lens and the two shall be sealed into a corrosion-resisting retainer so as to form a joint that will prevent the admission of liquid or gas between the reflector and lens.

2. When the reflector unit is of the single refraction type the reflector backing shall consist of a coat of metallic silver. It shall be homogeneous, evenly applied to the surface of the glass and be so fitted as to form an air-tight

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 155-39.

RAILROAD HIGHWAY GRADE CROSSING SIGNS

Official Approval

Sept. 1933, July 1937, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing signs of various designs for railroad highway grade crossing protection. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

(c) Drawings forming an essential part hereof are as follows:

1. 90 Deg. Cast-Iron Crossing Sign—Drawing 1640.
2. Adapter Clamp for Crossing Signs—Drawing 1641.
3. 90 Deg. Reflector Crossing Sign Assemblies—Drawing 1642.
4. 90 Deg. Reflector Crossing Sign Details—Drawing 1643.
5. Cast-Iron Multiple Track Sign—Drawing 1644.
6. Reflector Multiple Track Sign—Drawing 1645.
7. Reflector Stop on Red Signal Sign—Drawing 1646.
8. Adapter Clamp and Details for Signs—Drawing 1647.
9. Reflector Stop When Swinging Sign—Drawing 1648.
10. Details of Numerals for Track Signs—Drawing 1650.
11. Bolts for Crossing Signs—Drawing 1655.
12. ....

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 163-39.

WEATHERPROOF COVERING FOR LINE WIRE

Official Approval

Dec. 1935, July 1939.

1. *Purpose and scope.*

(a) This specification is for the purpose of providing double and triple braid or equivalent weatherproof coverings to be applied to line wires, sizes Nos. 4 to 12 A.W.G., inclusive. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

(b) This specification covers the fibrous coverings, saturating and finishing compounds, acceptance requirements for the finished wire weights and tolerances, packing and marking for shipment.

2. *Conductor.*

(a) Specifications for bare conductors shall be those of the Signal Section, Association of American Railroads.

3. *Fibrous coverings.*

(a) Conductor shall be covered as the order may specify with either two or three closely woven braids of cotton or an equivalent filling of unspun cotton wrapped spirally around the wire in place of the inner braid or braids. The outer braid in all cases is to be of cotton yarn of not less than two ply and in the manufacturing process, in any one braid, each carrier or bobbin shall carry the same size and the same number of ends of cotton yarn. The inner braids may contain single ply cotton yarn.

(b) In all cases the outer braid shall be made of yarns equal to or larger in size and heavier in weight than the yarns used in the inner braids. When other fibrous material is substituted for the inner braids, the outer braid shall comply with that required for the equivalent size of triple braid covered wire.

4. *Saturant.*

(a) The fibrous covering shall be saturated with a black asphaltic weather-resisting compound, meeting the specifications and test requirements for compound in this specification. This compound shall be applied in a sufficient quantity to fill the interstices and to provide a homogeneous covering of the braids. The saturation shall be so thorough that no white ends will be exposed by a diagonal cut through the braids to the conductor. It shall be a non-conductor, insoluble in water.

(b) The quality of the saturating compound used and the method of application shall be such that the fibrous covering

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 130-39.

CIRCUIT CONTROLLER FOR DRAWBRIDGES

Official Approval

Dec. 1923, July 1929, Aug. 1936, Aug. 1938, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a circuit controller for the opening and closing of first and second voltage range electrical circuit between the shore structures and bridge ends of drawbridges. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Controller shall consist of two members, one stationary and one movable. The movable member shall permit of a minimum 10 in. stroke.

(b) Controller shall conform to the following drawings or references:

1. ....
2. ....

(c) Each member shall be enclosed in a substantial metallic case, designed to provide weatherproof protection for the contact members when controller is in the closed position. The covers when open shall permit access to all parts.

A.A.R. SIGNAL SECTION SPECIFICATION 95-39.

UNIVERSAL SWITCH CIRCUIT CONTROLLER

Official Approval

March 1921, July 1930, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing apparatus for application to track switches, derails or other movable apparatus for the control of signal circuits. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in alternate requisites section 9530 form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *General.*

(a) Movable parts except operating connections shall be enclosed in a weatherproof case.

(b) All parts of mechanism shall be readily removable. Like parts of the same design and manufacture shall be interchangeable.

(c) Two-position controllers shall have four front and four back dependent contacts. *R-6-c.

(d) Three-position controllers shall have four front and four back dependent contacts. *R-6-d.

---

* Section 9530. Alternate requisites.

PRINTED IN U. S. A.

18. *Dielectric requirements.*

(a) Electrical apparatus assembled shall withstand for one minute an insulation test, at place of manufacture, of 3,000 volts a.c. between all parts of electric circuits and other metallic parts insulated therefrom.

(b) A surface leakage distance of not less than ¼ in. shall be provided between any exposed metallic part of the apparatus carrying current and any other metallic part thereof.

19. *Painting.*

(a) Case, cover and crank shall be painted on all sides in accordance with Specification 120.

20. *Inspection.*

(a) Purchaser may inspect material at all stages of manufacture.

(b) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(c) If material has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and the Contractor, upon request, shall advise the Purchaser what disposition is to be made of the rejected material. Contractor shall pay all freight charges.

(d) If Purchaser is to make inspection at point of production it shall be so stated.

21. *Tests.*

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Contractor shall give the Purchaser sufficient notice of time when material will be ready for testing.

(c) Contractor shall provide, at point of production, apparatus and labor for making required tests under supervision of the Purchaser.

(d) If tests are to be made at point of production, the Purchaser shall so state and also indicate which of the tests herein specified are to be made and what portion of the material shall be tested.

A.A.R. SIGNAL SECTION SPECIFICATION 162-39.

ELECTRIC COLOR POSITION LIGHT SIGNAL

Official Approval
Dec. 1935, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing an electric color position light signal. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) The general design, dimensions and structure of signal shall conform to Purchaser's drawings.

(b) Detail design of signal shall be approved by Purchaser.

(c) Like parts of same Manufacturer's apparatus shall be interchangeable.

7. *High signal.*

(a) High signal shall be a combination of lamp units, the main group of which shall have the units located on a 14 in. radius.

(b) Auxiliary units shall be mounted 7 ft. above or below and in a vertical line with center of main group or offset 3 ft. 4 in. from a unit so mounted.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 148-39.

ALTERNATING CURRENT POWER TRANSFER RELAY

Official Approval

July 1930, July 1937, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing an alternating current power transfer relay for transferring not exceeding 15 volts a.c. to an alternating or direct current reserve source of power not exceeding 15 volts. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Relay shall be of a design approved by the Purchaser.

(b) Relay shall be of the d.c. tractive armature type equipped with a copper-oxide rectifier for a.c. operation. Rectifier shall be in accordance with Specification 166.

(c) Relay shall be furnished with two dependent front and back contacts. *R-6-c.

---

* Alternate requisites section.

PRINTED IN U. S. A.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

(a) [illegible]

[illegible]

(a) [illegible]

[illegible]

[illegible]

(a) [illegible]

(b) [illegible]

(c) [illegible]

A.R.A. SIGNAL SECTION INSTRUCTIONS.

MAINTAINING AND TESTING MOTOR SEMAPHORE SIGNALS

1930

Official Approval

July 1930.

General.

1. Mast must be vertical and signal aligned to give the best possible indication for approaching trains.

2. Signal blades, lenses and roundels must be kept clean.

3. Lamp bracket must be securely fastened and adjusted to insure proper alignment of lamp with respect to spectacle and track. All parts of lamp must clear spectacle not less than 1 inch.

4. Ladders, hand railings and platforms must be kept in good condition and securely fastened.

5. Base of ladder must be secured to a suitable support.

6. Movable parts of the signal must move freely under all weather conditions.

7. Semaphore spectacle casting must rest against the stop provided for that purpose, allowing slot-arms and vertical connections to be free from all downward pressure when in the most restrictive position.

8. Signals must not be placed in service until semaphore bearings have been cleaned, and all oil, dirt and grease removed from the armature and poles of slot magnets and gears, all parts lubricated, and electrical torque tests made when practicable.

9. Bearings must be kept free from grit and dirt, and lubricated.

10. Semaphore shaft bearings must be lubricated in accordance with detailed instructions.

11. Cone clutch between motor shaft and pinion gear on signals so equipped must be kept free from oil and lubricated in accordance with detailed instructions.

12. Bearings and movable parts except those covered in Instructions 10 and 11 must be oiled monthly with Specification 102 or 103 oil.

13. Mechanism must be kept in proper adjustment and without excessive lost motion. Excessively worn or defective parts must be replaced.

14. Slot or equivalent device must release on voltage not less than that specified by manufacturer.

PRINTED IN U. S. A.

15. Air gap between movable and fixed member of slot or retaining device must be not less than that specified by manufacturer. Movable and fixed member of slot or retaining device must be kept free from grease, oil and dirt.

16. Electrical contacts must be kept clean and in proper adjustment. Cloth free from lint (chamois preferable) must be used to clean contacts.

17. Buffing of signal must be effective and at the proper time to eliminate undue strain on mechanism.

18. Armature of signal motor must not have excessive lost motion in bearing and the clearance between armature and field piece on direct current motors and between rotor and stator on alternating current motors specified by manufacturer must be maintained.

19. Commutator must be smooth, clean and have a glossy appearance and oiled, if necessary, by using a cloth free from lint (chamois preferable) moistened with Specification 102 or 103 oil. Segment wires must be securely fastened to segments. Where composition brushes are used, commutator must be kept free from oil.

20. Number 00 or finer sandpaper must be used on parts of mechanism and motor. Emery paper or emery cloth must not be used.

21. Brushes must be kept clean, fitted to commutator, free in brush holder, or brush holder free on stud (depending upon type of brush holder) and in the neutral plane either 90 or 180 degrees apart, as required. They must be free from hard spots on the contact surface. Springs must be in place and so maintained that brushes will have proper bearing.

22. Counters must be adjusted to correctly register operation of mechanism. Counters must not be oiled.

23. Wires must be so arranged that they will be neat and not interfere with operating parts of mechanism.

24. Buffers must be cleaned and lubricated in the Fall of each year. Air buffers using oil for lubricant must be oiled monthly with Specification 102 or 103 oil.

25. Door of mechanism case and motor housing must be kept in good working order, gasket in place and in good condition so as to keep out moisture and dirt. Door must not be opened in severe or stormy weather, except when conditions require.

26. Mechanism case must be kept clean and no material, tools or supplies kept therein. Ventilators must be protected by wire mesh and kept unobstructed.

27. Bolts, nuts, pins and cotters must be of proper size, kept in place, nuts tight, and cotters properly spread.

28. Broken or cracked roundels must be replaced.

29. Work that may interfere with the safe movement of trains must not be started until train movements have been fully protected.

30. Circuit controller contacts must be kept clean and properly adjusted.

31. Circuits must be kept free from grounds.

32. Signal apparatus must be tested in accordance with Instructions............

33. Manufacturer's instructions must be followed unless they conflict with general or detailed instructions in which case proper authority must be consulted for correct procedure.

Styles S and B Motor Signals

General.

34. Brushes must be set one slightly in advance of the other so they will bridge the space between adjacent segments of the commutator and in a staggered position with a slight overlap to prevent wearing a groove in the commutator.

35. Contact tips on circuit controller springs must be kept tight.

36. Contact tips on circuit controller springs must make full surface and sliding contact on contact post, or spring, to prevent arcing.

37. Semaphore shaft journals must be packed with lubricant specified by manufacturer (or its equivalent), and replenished at least once every six months. The lubricant must be kept in a semi-fluid state by adding a small amount of Specification 102 or 103 oil when necessary.

38. Chains and sprockets must be cleaned when necessary with gasoline and coated lightly with a grease similar to that used for semaphore bearings.

39. To avoid improper operation of the signal, the slot toggle adjustment must not be changed from its original setting. Links are stamped 1, 3 or 5, meaning $\frac{1}{4}$, $\frac{3}{8}$ or $\frac{5}{32}$ inch toggle, respectively. If adjustment of toggle changes from that stamped on link, due to wear, slot-arm must be replaced.

40. Lifting chains must be so maintained that with a spring balance over the chain at a point midway between the upper and lower shafts and with a horizontal pull of 5 pounds, the distance between center lines will not be less than $2\frac{1}{8}$ inches nor more than $2\frac{5}{16}$ inches for Style S signals, nor less than $1\frac{7}{8}$ inches nor more than $2\frac{1}{16}$ inches for Style B signals.

41. Motor brake must be so set that the overtravel of rollers after leaving the end of lifting fork will be not more than $\frac{1}{2}$ inch beyond the top of sprocket when motor is operated at rated voltage. With motor operating, brake shoe must clear brake wheel 0.020 inch.

64. Buffer cylinders must be lubricated once each month by removing the plug containing the vent and dropping a small amount of approved oil into the cylinder. The outside of the cylinder must be wiped clean before the plug is removed and special care taken that no dirt or grit enters the cylinder.

65. With buffers properly maintained and adjusted, signal arm will move from the 90 to the zero degree position in not more than 6 seconds.

Model 2-A Signals

66. Semaphore shaft bearings must be lubricated with Specification 102 or 103 oil.

67. On signals with dynamic indication only sufficient tension must be maintained on storing spring to insure that proper indication is received.

68. Where locking dog in main bearing is used, it must be given an application of an approved lubricant at least once each year.

69. When assembling mechanisms to pole bearings, exposed mechanical joints must be cleaned and evenly coated with white lead to insure watertight joints.

70. Semaphore shaft and mechanism must be in approximately the Stop position when bolting mechanism to its pole bearing. Semaphore shaft should be rotated backward and forward when tightening bolts to insure that no binding takes place between moving parts.

71. Fibre washers in the clutch, and the pawl and ratchet pinion must be lubricated at least semi-annually with Specification 102 or 103 oil.

72. Motor shaft must have at least 1/64 inch and not more than 3/64 inch end play.

73. Clearance between motor armature and pole pieces must be not less than 0.025 inch measured with a metal gage as furnished by the manufacturers, 0.015 inch thick and 1½ inches wide, circular in form.

74. Air gap between the pole pieces of the hold clear coil and armature must be not less than 0.022 inch.

75. An air gap of at least 1/16 inch must be maintained between armature and armature support, with slot coil energized and the signal at rest in the 45 or 90 degree position.

76. Occasional tests must be made to insure that snub is effective. Signal should travel from the 90 to the zero degree position in approximately 8 seconds when controlling circuit is opened. The ratcheted main gear should click three or four times when signal is moving from the 90 to the zero degree position.

77. Motor friction clutch must be adjusted to slip, when blade is held and current applied, with normal voltage at motor terminals.

A.A.R. SIGNAL SECTION SPECIFICATION 13-39.

HARD FIBRE

Official Approval
Dec. 1923, Dec. 1935, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing hard fibre for use in railroad track joints, switch rods, signal pipe, etc., for track circuit insulations. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

3. *Tender.*

(a) The tender shall be for hard fibre meeting the requirements of this specification in its entirety.

4. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

5. *Tests.*

(a) Tests may be made at point of production, or on samples submitted, prior to shipment at point designated by Purchaser.

(b) Contractor shall give the Purchaser sufficient notice of time when material will be ready for testing.

(c) Contractor shall provide, at point of production, apparatus and labor for making required tests under supervision of the Purchaser.

(d) When desired by the Purchaser, a report shall be made by the Manufacturer giving a record of the tests of the samples taken from each lot.

(e) If tests are to be made at point of production, the Purchaser shall so state and also indicate which of the tests herein specified are to be made and what portion of the material shall be tested.

6. *Samples for tests.*

(a) Three samples shall be selected at random by the Purchaser or his representative from each lot or part thereof of 25 sheets of the same specified thickness, or 500 fabricated pieces of the same specified thickness. Test pieces of the re-

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 177-39.

INSULATING MATERIAL FOR FILLING AND SEALING RECESSES IN SIGNAL APPARATUS

Official Approval

July 1937, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing insulating material for filling and sealing recesses in porcelain, glass, metal, rubber, wood or other materials housing electrical terminals or other conductors. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Tender.*

(a) The tender shall be for insulating material meeting the requirements of this specification in its entirety.

3. *Material.*

(a) Material shall be first-class in every respect.

4. *Adhesive qualities.*

(a) Material must adhere to the surface of recesses. It must not flow at 200 deg. F. nor flake or crack above minus 40 deg. F. and shall not shrink more than 2 per cent when cooled from 68 deg. F. to minus 40 deg. F.

5. *Neutral qualities.*

(a) Material shall be free from acids, alkalies or other substances that will cause corrosion.

6. *Tests.*

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Contractor shall give the Purchaser sufficient notice of time when material will be ready for testing.

(c) Contractor shall provide, at point of production, apparatus and labor for making required tests under supervision of the Purchaser.

(d) If tests are to be made at point of production, the Purchaser shall so state and also indicate which of the tests herein specified are to be made and what portion of the material shall be tested.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 96-39.

FUSES

Official Approval

March 1921, July 1930, Sept. 1933, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing cartridge, plug and link fuses. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

5. *Design.*

(a) The casings for enclosed fuses shall be sufficiently tight so that lint and dust cannot collect around the fusible link and become ignited when the fuse is blown. For non-renewable fuses the fusible wire shall be attached to the terminals in such a way as to make it difficult for it to be replaced when melted.

(b) Enclosed fuses shall be classified to correspond with the different classes of cut-outs, and shall be so designed that it will be impossible to put any fuse of a given class into a cut-out which is designed for a current or voltage lower than that of the class to which the fuse belongs.

(c) Fuse terminals shall be sufficiently heavy to insure mechanical strength and rigidity. The types of terminals shall be as follows:

A.A.R. SIGNAL SECTION SPECIFICATION 29-39.

GALVANIZING FOR IRON OR STEEL

Official Approval
July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing in detail the tests to be applied to galvanized material. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

Note.—All specimens shall be capable of withstanding these tests.

2. *Coating.*

(a) Galvanizing shall consist of a continuous coating of pure zinc of uniform thickness, and so applied that it adheres firmly to the surface of the iron or steel. The finished product shall be smooth.

3. *Cleaning.*

(a) Samples shall be cleaned before testing, first with carbona, benzine or turpentine and cotton waste (not with a brush), and then thoroughly rinsed in clean water and wiped dry with clean cotton waste.

(b) Sample shall be clean and dry before each immersion in the solution.

4. *Solution.*

(a) The standard solution of copper sulphate shall consist of commercial copper sulphate crystals dissolved in cold water, approximately in the proportion of 36 parts, by weight, of crystals to 100 parts, by weight, of water. The solution shall be neutralized by the addition of an excess of chemically pure cupric oxide (CuO). The presence of an excess of cupric oxide will be shown by the sediment of this reagent at the bottom of the containing vessel.

(b) The neutralized solution shall be filtered before using by passing through filter paper. The filtered solution shall have a specific gravity of 1.186 at 65 deg. F. (reading the scale at the level of the solution) at the beginning of each test. In case the filtered solution is high in specific gravity, clean water shall be added to reduce the specific gravity at 1.186 at 65 deg. F. In case the filtered solution is low in specific gravity, filtered solution of a higher specific gravity shall be added to make the specific gravity 1.186 at 65 deg. F.

PRINTED IN U. S. A.

4. *Solution.*—Continued.

(c) As soon as the stronger solution is taken from the vessel containing the unfiltered neutralized stock solution, additional crystals and water must be added to the stock solution. An excess of cupric oxide shall always be kept in the unfiltered stock solution.

5. *Quantity of solution.*

(a) Wire samples shall be tested in a glass jar of at least 2 in. inside diameter. The jar without the wire samples shall be filled with standard solution to a depth of at least 4 in. Hardware samples shall be tested in a glass or earthenware jar containing at least ½ pint of standard solution for each hardware sample.

(b) Solution shall not be used for more than one series of four immersions.

6. *Samples.*

(a) Not more than seven wires shall be simultaneously immersed, and not more than one sample of galvanized material other than wire shall be immersed in the specified quantity of solution.

(b) Samples shall not be grouped or twisted together, but shall be well separated so as to permit the action of the solution to be uniform upon all immersed portions of the samples.

7. *Test.*

(a) Clean and dry samples shall be immersed in the required quantity of standard solution in accordance with the following cycle of immersions.

(b) Temperature of the solution shall be maintained between 62 and 68 deg. F. at all times during the following test:

1. Immerse for one minute, wash and wipe dry.
2. Immerse for one minute, wash and wipe dry.
3. Immerse for one minute, wash and wipe dry.
4. Immerse for one minute, wash and wipe dry.

(c) After each immersion the samples shall be immediately washed in clean water having a temperature between 62 and 68 deg. F. and wiped dry with cotton waste.

(d) In the case of No. 14 B.W.G. galvanized iron or steel wire, the time of the fourth immersion shall be reduced to ½ minute.

PRINTED IN U. S. A.

8. *Acceptance.*

(a) If after the test described in section 7-a, there should be a bright metallic copper deposit upon the samples, the lot represented by the samples shall be rejected.

(b) Copper deposits on zinc or within 1 in. of the cut end shall not be considered causes for rejection.

(c) In the case of a failure of only one wire in a group of seven wires immersed together, or if there is a reasonable doubt as to the copper deposit, two check tests shall be made on these seven wires and the lot reported in accordance with the majority of the sets of tests.

Note.—The equipment necessary for the tests herein outlined is as follows:

Filter paper.
Commercial copper sulphate crystals.
Chemically pure cupric oxide (CuO).
Running water.
Warm water or ice, as per needs.
Carbona, benzine or turpentine.
Glass jars at least 2 in. inside diameter by at least 4½ in. high.
Glass or earthenware jars for hardware samples.
Vessels for washing samples.
Tray for holding jars of stock solution.
Jars, bottles and porcelain basket for stock solution.
Cotton waste.
Hydrometer cylinder 3 inches in diameter by 15 in. high.
Thermometer with large Fahrenheit scale correct at 62 and 68 deg.
Hydrometer correct at 1.186 at 65 deg.

PRINTED IN U. S. A

A.A.R. SIGNAL SECTION SPECIFICATION 14-39.

DIRECT CURRENT GENERATOR

Official Approval

Sept. 1932, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a direct current generator. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Contractor shall furnish with his tender, drawings forming an essential part thereof.

(b) Contractor shall furnish drawings or references showing the following information:

1. Outline drawing giving over-all dimensions, dimensions of shaft extension, and method of bringing out leads; also type and dimensions of conduit terminal box and exact location if furnished.
2. Foundation drawing giving size and exact location of anchor bolts.
3. Drawing or reference of rheostat, regulator and other accessories, giving exact drilling dimensions, including diagrammatic sketch of connections.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

(b) Contractor shall furnish with his tender the following information:

1. Guaranteed temperature rise.
2. Efficiencies at ½, ¾ and full loads.
3. Voltage regulation.

4. *Alternates.*

(a) The provisions contained in alternate requisites section 1432 form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

A.A.R. SIGNAL SECTION SPECIFICATION 59-39.

KEROSENE HAND LANTERN GLOBES

Official Approval

July 1927, Aug. 1938, July 1939.

PART A

1. *Purpose.*

(a) Part A of this specification is for the purpose of defining the minimum values of luminous transmission for hand lantern globes and the limits of chromaticity for the colors produced by the globes in combination with a kerosene illuminant.

2. *Scope.*

(a) The specification covers the so-called red, yellow, green, and blue colors used in railroad signaling.

3. *Basis.*

(a) The values given in the specifications were derived from spectrophotometric data obtained by the Colorimetry Section, National Bureau of Standards, with defining glasses selected by Committee VI of the Signal Section; these values were computed on the following basis:

1. Observer and coordinate system: 1931 I.C.I. Standard. (See section 4.)
2. Illuminant: Planckian radiator at 2360°K for values of T_{AAR} and T_r/T_w, Planckian radiator at 1900°K (kerosene illuminant) for values of x, y and z ($C_2=14350$ micron degrees).
3. Angular distribution of illumination: approximately at right angles to the surface of the glass.
4. Angle of view: approximately at right angles to the surface of the glass.

(b) The conditions just specified shall be used in testing glasses for conformity to Parts A and B of this specification.

4. *Explanatory.*

(a) Any color can, in general, be adequately specified in terms of three colorimetric quantities. In the case of the signal colors the three quantities adequate for the purpose are two numbers defining the chromaticity of the color (*i.e.*, its hue and saturation) and one number defining the luminous transmission of the glass. Since no two observers would, in general, get the same numbers by direct observation (because of differences in lumi-

PRINTED IN U. S. A.

PART B

(Specification 59-39)

1. *Purpose.*

(a) Part B of this specification is for the purpose of defining the maximum deviations from the standard limit glasses, both in transmission and in chromaticity, to be permitted in glasses certified as duplicates of the standard limit glasses.

2. *Transmission.*

(a) The luminous transmissions on the AAR scale, T_{AAR}, of certified duplicate limit glasses shall be as follows, the illuminant being operated at 2360°K:

Color designation	Light limit	Dark limit
Red	250 ± 15	145 ± 5
Yellow	300 ± 15	250 ± 15
Green	185 ± 10	127 ± 5
Blue	125 ± 5	56 ± 3

Note.—It may be noted that in some cases a certified dark limit glass may have, in accordance with this table, a value of T_{AAR} slightly less than that given in Parts A and C of this specification; this does not, however, invalidate Parts A and C, which must be met by all globes to be used in railroad signaling.

(b) In addition, for the blue glasses, the ratio of red to total luminous transmission, T_r/T_w, shall be as follows, the illuminant being operated at 2360°K:

Color designation	Light limit	Dark limit
Blue	0.014 ± 0.002	0.008 ± 0.002

3. *Chromaticity.*

(a) All certified duplicate limit glasses shall pass Part A of this specification with respect to the trichromatic coefficients, x, y and z; they must also pass the additional specification given in Table I. In Table I are given first the values of x, y and z for the standard limit glass with kerosene (1900°K) illuminant, followed by the maximum deviations from these values which are permitted in the certified duplicate glass. However, it is unnecessary to give permissible deviations for more than two of these three coefficients, since the sum of x, y and z is always unity.

PART C

(Specification 59-39)

1. *Purpose.*

(a) Part C of this specification is for the purpose of providing approved kerosene hand lantern globes, to describe the materials and specify the appliances and appurtenances necessary to make the required tests and inspection. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Globes shall conform to Drawing 1611.

3. *Identification.*

(a) Lettering specified in the order shall have the marking blown, etched, or sand blasted upon the globe.

(b) Globes shall have the Manufacturer's trade-mark marked not more than 1½ in. below the top of the globe.

4. *Material and workmanship.*

(a) Globes shall be made of low expansion heat-resisting glass and have both ends finished without sharp edges.

(b) Quality and processing shall be of the best for the purpose. The composition must be durable on prolonged exposure to weather; all globes shall be true to size and form, free from cloudiness, streaks, wrinkles, chips or bubbles that in any way detract from their efficiency or use. Colored globes shall be uniformly colored; flashed globes will not be accepted.

5. *Inspection.*

(a) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(b) If Purchaser is to make inspection at point of production it shall be so stated.

(c) If material has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and the Contractor, upon request, shall advise the Purchaser what disposition is to be made of the rejected material. Contractor shall pay all freight charges.

(d) Contractor shall give sufficient notice of the time when globes are ready, provide at his place of test all apparatus and appurtenances and supply labor necessary to make the required tests and inspection.

(e) When tests and inspection are made at the Purchaser's laboratory such globes as are rejected will be held for one month from date report is mailed to the Contractor. If the Contractor is dissatisfied with results of test he may claim for rehearing within that time. Failure to claim a rehearing will be construed as evidence of his satisfaction with the report.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 74-39.

IMPEDANCE BOND

Official Approval

May 1920, Sept. 1932, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing an impedance bond to permit propulsion current to flow around insulated rail joint without interfering with the functioning of the track circuit. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in alternate requisites section 7432 form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Impedance bond shall be of a design approved by the Purchaser.

(b) Case and cover shall be of cast iron and waterproof. *R-6-b.

(c) Lugs on the case shall be located so that the impedance bond can be supported between ties.

(d) Bond shall be so constructed as to protect against loss of the cooling medium.

(e) Bond terminal lugs shall be furnished with bond. They shall be of such design as to fit the cables specified in Purchaser's order.

(f) Cover of bond shall be ramped to minimize danger of damage from dragging equipment.

---

* Section 7432. Alternate requisites.

A.A.R. SIGNAL SECTION SPECIFICATION 173-39.

COPPER-COVERED STEEL GUY AND MESSENGER STRAND

Official Approval

July 1937, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing copper-covered steel seven-wire and three-wire strand for use as messengers in supporting aerial cable and for the guying of overhead lines. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Material.*

(a) The strand shall be composed of round copper-covered steel wires, either high strength or extra high strength as specified in the order. Each wire shall be composed of a steel core with a copper covering thoroughly welded thereto, so that an inseparable and interlocking crystalline union is secured between the two metals. All wires in the strand shall be of the same grade and quality.

3. *Properties.*

(a) Finished strand.

1. The strand shall have properties and characteristics in accordance with the following requirements:

Nominal size	Diameter of strand in inches	Breaking load, lb.		Weight	
		High strength	Extra high strength	lb. per 1000 ft.	lb. per mile
½ (7 No. 6)	0.486	16,880	20,410	515	2,720
7⁄16 (7 No. 7)	0.432	13,860	16,820	407	2,149
3⁄8 (7 No. 8)	0.384	11,340	13,800	322	1,700
11⁄32 (7 No. 9)	0.342	9,320	11,280	255	1,346
5⁄16 (7 No. 10)	0.306	7,750	9,200	204	1,077
3 No. 6	0.349	6,830	8,260	220	1,162
3 No. 7	0.310	5,610	6,800	174	919
3 No. 8	0.276	4,590	5,580	138	729
3 No. 9	0.246	3,770	4,560	109	576
3 No. 10	0.220	3,140	3,720	87	460

(b) Pitch and lay.

1. The pitch of the strand shall be not less than 12 nor more than 16 times the diameter of a circle which circumscribes the strand.

2. The outer layers of the strand shall be arranged concentrically about a wire center with a left-hand lay, unless

25. ***Batteries.***

(a) Batteries shall be in accordance with the following specifications and drawings:

1. Nickel, Iron, Alkaline Storage Battery—Specification 49.
2. Lead Acid Stationary Storage Battery (Plates of Pure Lead)—Specification 58.
3. Lead Type Portable Storage Battery for Signaling—Specification ...., dated ....
4. Lead Acid Stationary Storage Battery (Plates of Alloy Composition)—Specification 158.
5. Lead Acid Stationary Storage Battery (Plates of Composite Structure)—Specification 53.
6. Specification for Electrolyte.
7. Type "A" Copper-Oxide Caustic Soda Primary Cell—Specification 87.
8. Type "B" Copper-Oxide Caustic Soda Primary Cell—Specification 171.
9. Battery Jar (Primary)—Specification 113.
10. Battery Jar (Storage)—Specification ...., dated ....
11. Round Jars and Cover—Drawing 1053.
12. Rectangular Jars and Cover—Drawing 1419.

(b) Jars for caustic soda type of battery shall conform to Drawing ...., dated ....

(c) Main operating batteries shall consist of .... sets .... cells of .... type .... a.h. capacity.

(d) Local operating batteries shall consist of:

1. .... sets .... cells of .... type .... a.h. capacity.
2. .... sets .... cells of .... type .... a.h. capacity.

(e) Track batteries shall be of .... cells of .... type .... a.h. capacity.

(f) Line batteries shall be of .... cells of .... type .... a.h. capacity.

(g) Supports for batteries in interlocking station shall be furnished in place by the .... and shall conform to Drawing ...., dated ....

(h) The initial charge of storage battery shall be conducted by the .... Current at the proper voltage for initial charge shall be provided by ....

(i) The .... shall furnish with each set of main battery, one hydrometer and one battery thermometer.

(j) Installation of various types of batteries shall be in accordance with the following instructions:

39. *Signals.*—Continued.

of shaft. Operating arm shall be mounted on square section of shaft or otherwise securely fastened.

(d) Enameled steel signal blades shall conform to Drawings 1548 and 1568. *R-39-d.

(e) Wood signal blades shall conform to Drawing 1065. *R-39-e.

(f) Signals shall be in accordance with the following specifications and drawings, where applicable:

1. Electric Motor Semaphore Signal—Specification 79.
2. Electric Color Light Signal—Specification 80.
3. Electric Position Light Signal—Specification 81.
4. Electric Color Light Signal Operating Mechanism, Searchlight Type—Specification 157.
5. Electric Color Position Light Signal—Specification 162.
6. "U" Bolt and Clamp—Drawing 1083.
7. Filler Block—Drawings 1090, 1091 and 1092.
8. Ladders—Drawings 1365, 1366, 1583, 1619 and 1620.
9. Ladder Foundation—Drawing 1052.
10. Adapter-Base for Ground Mast Bottom Mechanism Signals—Drawing 1387.
11. Base for 4-Inch Mast—Drawing 1449.
12. Details and Assembly of Marker Lights—Drawing 1238.
13. Grade Signal Marker—Drawing 1612.
14. Take Siding Indicator—Dimensions and Lettering—Drawing 1551.

(g) Signals shall be aligned to give the best view to approaching trains as determined by the Purchaser.

(h) Before signals are erected, the Purchaser shall, in the presence of the Contractor's representative, designate the location of each signal.

(i) Signals and fittings not otherwise specified shall be in accordance with Manufacturer's recommended design subject to approval of Purchaser.

40. *Roundels, lenses and glass slides.*

(a) Roundels, lenses and glass slides shall be in accordance with Specification 69 and Drawing 1414.

(b) The following colors shall be used:

Indication	Color
1.	....
2.	....

(c) Roundels shall be securely fastened in the spectacles in a manner satisfactory to the Purchaser.

---

* Alternate requisites section.

45. *Signal lighting circuits.*—Continued.

(b) Alternating current at .... volts .... cycles distribution and .... volts .... watt lamps shall be used. *R-45-b.

(c) Where primary battery is used for lighting, voltage regulators shall be used. *R-45-c.

46. *Special circuits.*

(a) Special circuit requirements, in detail, are as follows:

1. ....
2. ....

47. *Wires and cables.*

(a) Wires and cables shall be in accordance with the following specifications (*R-47-a):

1. Specification for Galvanized Copper Bearing Steel Line Wire.
2. Specification for Steel Guy and Messenger Strand.
3. Bare Copper-Covered Steel Line Wire, Thirty Per Cent Conductivity—Specification 167.
4. Bare Copper Alloy Line Wire, Thirty Per Cent Conductivity—Specification 168.
5. Bare Hard-Drawn Copper Line Wire—Specification 169.
6. Weatherproof Covering for Line Wire—Specification 163.
7. Mineral Matter Rubber Compound Insulated Wire—Specification 111.
8. Aerial Aluminum Cable Steel Reinforced—Specification 54.
9. Aerial Braided Cable—Specification 89.
10. Armored Submarine Cable—Specification 90.
11. Lead-Covered Cable—Specification 91.
12. Parkway Cable—Specification 145.
13. Fibrous-Covered Non-Metallic Sheath for Railway Signal Cable—Specification 161.
14. ....
15. ....

48. *Size of wire.*

(a) Wire shall be of sufficient size to permit operation of switch and signal mechanisms in accordance with this specification.

(b) Single-conductor wires external to the interlocking station or instrument housings shall be not smaller than No. 14 A.W.G.

---

* Alternate requisites section.

24. *Rectifiers.*—Continued.

(a) ....

(b) Charging .... cells, type .... storage battery.

(c) Use in multiple with .... cells, type .... primary battery.

25. *Batteries.*

(a) Batteries shall be in accordance with the following specifications and drawings:

1. Nickel, Iron, Alkaline Storage Battery—Specification 49.
2. Lead Acid Stationary Storage Battery (Plates of Pure Lead)—Specification 58.
3. Lead Type Portable Storage Battery for Signaling—Specification ...., dated ....
4. Lead Acid Stationary Storage Battery (Plates of Alloy Composition)—Specification 158.
5. Lead Acid Stationary Storage Battery (Plates of Composite Structure)—Specification 53.
6. Specification for Electrolyte.
7. Type "A" Copper-Oxide Caustic Soda Primary Cell—Specification 87.
8. Type "B" Copper-Oxide Caustic Soda Primary Cell—Specification 171.
9. Battery Jar (Primary)—Specification 113.
10. Battery Jar (Storage)—Specification ...., dated ....
11. Round Jars and Cover—Drawing 1053.
12. Rectangular Jars and Cover—Drawing 1419.

(b) Jars for caustic soda type of battery shall conform to Drawing ...., dated ....

(c) Main operating batteries shall consist of .... sets .... cells of .... type .... a.h. capacity.

(d) Local operating batteries shall consist of:

1. .... sets .... cells of .... type .... a.h. capacity.
2. .... sets .... cells of .... type .... a.h. capacity.

(e) Track batteries shall be of .... cells of .... type .... a.h. capacity.

(f) Line batteries shall be of .... cells of .... type .... a.h. capacity.

(g) Supports for batteries in interlocking station shall be furnished in place by the .... and shall conform to Drawing ...., dated ....

54. *Signals.*—Continued.

(h) Signals shall be in accordance with the following specifications and drawings, where applicable:

1. Electric Motor Semaphore Signal—Specification 79.
2. Electric Color Light Signal—Specification 80.
3. Electric Position Light Signal—Specification 81.
4. Electric Color Light Signal Operating Mechanism, Searchlight Type—Specification 157.
5. Electric Color Position Light Signal—Specification 162.
6. "U" Bolt and Clamp—Drawing 1083.
7. Filler Block—Drawings 1090, 1091 and 1092.
8. Ladders—Drawings 1365, 1366, 1583, 1619 and 1620.
9. Ladder Foundation—Drawing 1052.
10. Adapter-Base for Ground Mast Bottom Mechanism Signals—Drawing 1387.
11. Base for 4-Inch Mast—Drawing 1449.
12. Details and Assembly of Marker Lights—Drawing 1238.
13. Grade Signal Marker—Drawing 1612.
14. Take Siding Indicator—Dimensions and Lettering—Drawing 1551.

(i) Signals shall be aligned to give the best view to approaching trains as determined by the Purchaser.

(j) Before signals are erected, the Purchaser shall, in the presence of the Contractor's representative, designate the location of each signal.

(k) Signals and fittings not otherwise specified shall be in accordance with Manufacturer's recommended design subject to approval of Purchaser.

55. *Roundels, lenses and glass slides.*

(a) Roundels, lenses and glass slides shall be in accordance with Specification 69 and Drawing 1414.

(b) The following colors shall be used:

Indication	Color
1.	....
2.	....

(c) Roundels shall be securely fastened in the spectacles in a manner satisfactory to the Purchaser.

56. *Lamps.*

(a) Electric lamp cases shall conform to Drawing 1563. *R-56-a.

---

* Alternate requisites section.

61. *Special circuits.*

(a) Special circuit requirements, in detail, are as follows:

1. ....
2. ....

62. *Wires and cables.*

(a) Wires and cables shall be in accordance with the following specifications (*R-62-a):

1. Specification for Galvanized Copper Bearing Steel Line Wire.
2. Specification for Steel Guy and Messenger Strand.
3. Bare Copper-Covered Steel Line Wire, Thirty Per Cent Conductivity—Specification 167.
4. Bare Copper Alloy Line Wire, Thirty Per Cent Conductivity—Specification 168.
5. Bare Hard-Drawn Copper Line Wire—Specification 169.
6. Weatherproof Covering for Line Wire—Specification 163.
7. Mineral Matter Rubber Compound Insulated Wire—Specification 111.
8. Aerial Aluminum Cable Steel Reinforced—Specification 54.
9. Aerial Braided Cable—Specification 89.
10. Armored Submarine Cable—Specification 90.
11. Lead-Covered Cable—Specification 91.
12. Parkway Cable—Specification 145.
13. Fibrous-Covered Non-Metallic Sheath for Railway Signal Cable—Specification 161.
14. ....
15. ....

63. *Size of wire.*

(a) Wire shall be of sufficient size to permit operation of switch and signal mechanisms in accordance with this specification.

(b) Single-conductor wires external to the interlocking station or instrument housings shall be not smaller than No. 14 A.W.G. Single-conductor wires within the interlocking station or instrument housings shall be not smaller than No. 16 A.W.G.

(c) Wires in cable external to the interlocking station shall be not smaller than No. 16 A.W.G.

(d) Line wires shall be not smaller than No. 10 A.W.G. for hard-drawn copper or copper alloy, or No. 12 A.W.G. for copper-covered steel.

---

* Alternate requisites section.

PRINTED IN U. S. A.

18. *Power plant.*

(a) Power plant shall consist of ....

(b) .... shall be furnished by .... and installed by ....

(c) .... shall be furnished by .... and installed by ....

19. *Auxiliary power plant.*

(a) Auxiliary power plant when required shall consist of ....

(b) .... shall be furnished by .... and installed by ....

(c) .... shall be furnished by .... and installed by ....

20. *Air compressors, in duplicate, governors and strainers.*

(a) Air compressors, in duplicate $\left\{\begin{array}{l}\text{one-stage}\\ \text{compound}\end{array}\right\}$ with a capacity of .... cubic ft. piston displacement free air per minute, and designed for air pressure of .... lb., manufactured by ...., installed by ...., shall be furnished on a .... foundation, to be furnished in place by ...., constructed in accordance with the specifications which shall be attached to the Contractor's bid. *R-20-a.

(b) Automatic governors shall be provided by .... and shall be arranged to cut in the compressor at .... lb. and cut out at .... lb. pressure. *R-20-b.

(c) An air strainer, of a design which shall be approved by the Purchaser, shall be installed in each air intake pipe.

(d) When air compressors are furnished in duplicate, interchange control panels shall be furnished with same for operating each compressor from either of the governors. *R-20-d.

(e) Air compressors shall be direct-connected and motor-driven and shall be mounted on a cast-iron base. Motor shall be in accordance with A.I.E.E. Standards. *R-20-e.

21. *Generator.*

(a) Electric generator shall be of .... k.w. capacity at .... frequency, ... volts, ... phase a.c.; or .... volts d.c., and shall be in accordance with Specification 14.

22. *Motor.*

(a) Motor shall be .... h.p. capacity at .... frequency, ... volts, ... phase a.c.; or .... volts d.c., and shall be in accordance with A.I.E.E. Standards. *R-22-a.

---

*Section 6733. Alternate requisites.

29. *Air reservoirs.*—Continued.

(b) Extra large reservoirs called expansion tanks shall be used to provide a stand-by air supply. These reservoirs shall be properly equipped for drainage. *R-29-b.

30. *Air pipe lines.*

(a) Main air line shall be best quality galvanized extra strong wrought iron or steel pipe 2 inches in diameter, and equipped with metallic thread protecting sleeves. *R-30-a.

(b) Branch air line shall be best quality galvanized extra strong wrought iron or steel pipe, ¾ in. to supply switches and ½ in. to supply signals.

(c) All pipe shall be specified for air service free from zinc oxide or other foreign matter that might scale off.

(d) Pipe 1½ inches in diameter and larger shall be lapweld; pipe of lesser diameter may be buttweld.

(e) Each length of pipe larger than ¾ in. shall be provided with two thread protectors and one extra heavy galvanized recessed coupling, shipped separately in boxes. Pipes of lesser diameter may be shipped in bundles with one end protected with heavy burlap and the extra heavy galvanized recessed coupling turned on the pipe hand tight.

(f) Expansion joints for pipes 2 inches in diameter shall have an iron body, a brass or iron sleeve and allowance for 6 in. expansion. *R-30-f.

(g) Gate or globe valve shall have brass seat, rising stem, ... ends for .... in. pipe and designed for a working air pressure up to 150 lb. per sq. in. *R-30-g.

(h) Stop cocks, screw unions, combination stop cocks and screw unions shall be provided with brass seats and shall be tested to 150 lb. pressure per sq. in. *R-30-h.

(i) Flexible connections shall be best quality ½ in. armored hose having 3 in. nipple inserted and securely fastened in each end and having not less than 16 in. of hose between the ends of the nipples. Complete connection shall be capable of withstanding a working pressure of 150 lb. per sq. in.

(j) All iron pipe fittings including tees, elbows, street ells, and reducers, shall be A.R.A. Mechanical Division 300 lb. extra heavy malleable iron or steel, galvanized. Galvanizing shall be in accordance with Specification 29. *R-30-j.

(k) All pipe unions shall be A.R.A. Mechanical Division 300 lb. extra heavy malleable iron or steel, screw type with ground joint and brass to iron seat, galvanized. Galvanizing shall be in accordance with Specification 29. *R-30-k.

---

* Section 6733. Alternate requisites.

45. *Switchboard circuits.*

(a) Contractor's recommended arrangement of circuits shall be followed, subject to modifications to meet Purchaser's special requirements.

46. *Fouling circuits.*

(a) Fouling protection of non-interlocked turnouts and crossovers between home and distant signal shall conform to Form 7004. *R-46-a.

47. *Electric lighting circuits.*

(a) Circuits for electric lights shall conform to plan submitted by the Purchaser.

(b) The maximum allowable drop in potential on electric lighting circuits from switchboard to any lamp shall be 10 per cent.

(c) Alternating current at .... volts .... cycles distribution and .... volts .... watt lamps shall be used. *R-47-c.

48. *Special circuits.*

(a) Special circuit requirements, in detail, are as follows:

1. ....
2. ....

49. *Wires and cables.*

(a) Wires and cables shall be in accordance with the following specifications (*R-49-a):

1. Specification for Steel Guy and Messenger Strand.
2. Bare Copper-Covered Steel Line Wire, Thirty Per Cent Conductivity—Specification 167.
3. Bare Hard-Drawn Copper Line Wire—Specification 169.
4. Mineral Matter Rubber Compound Insulated Wire—Specification 111.
5. Aerial Aluminum Cable Steel Reinforced—Specification 54.
6. Aerial Braided Cable—Specification 89.
7. Armored Submarine Cable—Specification 90.
8. Lead-Covered Cable—Specification 91.
9. Parkway Cable—Specification 145.
10. ....
11. ....

---

* Section 6733. Alternate requisites.

50. *Size of wire.*

(a) Wire shall be of sufficient size to permit operation of switch and signal mechanisms in accordance with this specification.

(b) Single-conductor wires external to the interlocking station shall be not smaller than No. 14 A.W.G. Single-conductor wires within the interlocking station shall be not smaller than No. 16 A.W.G.

(c) Wires in cable external to the interlocking station shall be not smaller than No. 16 A.W.G.

(d) Line wires shall be not smaller than No. 10 A.W.G. for hard-drawn copper or No. 12 A.W.G. for copper-covered steel. *R-50-d.

(e) In cables, spare wires shall be provided as specified. When spare wires not in cable are required, the number and size shall be specified.

(f) Numbers and sizes of track circuit connections to each rail shall be as follows:

	No. of conductors	A.W.G.
1. Track transformers or batteries to rail		
2. Relay to each rail		
3. Fouling shunt connections		
4. Switch circuit controller shunt connections		

51. *Wiring.*

(a) Wiring shall be in accordance with Specification 119.

52. *Fuses.*

(a) Fuses shall be in accordance with Specification 96.

(b) Fuses shall be:

	Type	Voltage	Capacity
1.			
2.			

(c) Fuse clips shall be mounted on an insulating base of fireproof material.

(d) Necessary fuses to properly protect all apparatus and circuits, as required by the Purchaser, shall be installed by the Contractor.

(e) Fuses outside of buildings shall be enclosed in weatherproof boxes.

---

* Section 6733. Alternate requisites.

PRINTED IN U. S. A.

63. *Supports for wood trunking.*—Continued.

(h) When trunking is extended across ditch or other depression necessitating a span of more than 5 ft. it shall be reinforced by a piece of timber 4 in. by 6 in. laid horizontally and with suitable supports under reinforcing piece.

(i) Exposed trunking crossing under tracks containing other than track circuit wires shall be protected by metal covering between rails. *R-63-i.

64. *Bootlegs.*

(a) Wire connection to rail shall conform to Drawing ...., dated ....

65. *Junction boxes.*

(a) Junction boxes shall conform to Drawing ...., dated ....

(b) Junction boxes shall be located as shown on Drawing ...., dated ....

66. *Terminal boxes.*

(a) Terminal boxes shall conform to Drawing ...., dated ....

67. *Conduits.*

(a) Conduits shall be in accordance with A.R.A. Telegraph and Telephone Section Specification.

68. *Wire chases.*

(a) Wires within the interlocking station shall be run in conduit or chase of fireproof construction. Provision shall be made by the Purchaser in the interlocking station walls and floors for proper housing of all wires between machine and relay case and between relay case and first pull box outside of the interlocking station.

69. *Line material.*

(a) Pole line hardware shall be in accordance with A.R.A. Telegraph and Telephone Section Specification.

(b) Cross-arms shall be in accordance with A.R.A. Telegraph and Telephone Section Specification.

(c) Insulators shall be of .... type, ... material. Pin type porcelain insulators shall be in accordance with Specification 146.

---

* Section 6733. Alternate requisites.

A.A.R. SIGNAL SECTION SPECIFICATION 144-39.

DRY PROCESS PORCELAIN INSULATION

Official Approval

July 1928, Aug. 1936, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing dry process porcelain for electrical insulation of signal apparatus which is to be enclosed in housings for circuits of 660 volts or less. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for dry process porcelain insulation meeting the requirements of this specification in its entirety.

4. *Material and workmanship.*

(a) Material shall be of the best commercial grade so as to provide a homogeneous body or mass, which shall be close-grained, hard, tough, dense and uniform throughout.

(b) Parts shall be true to shape and free from sharp edges, projections, checks, flaws, cracks, chips, holes, laminations, metallic substances, or other irregularities or defects due to improper or imperfect mechanical treatment, faulty drying or firing, inconsistent with the best commercial manufacture.

(c) Surfaces of glazed parts shall be continuous, smooth, bright, firmly adherent, thoroughly vitrified and free from bubbles, air pockets, cracks, checks, crazing, metallic substances, undissolved particles or other injurious defects.

(d) In the compounding of the glaze, lead oxide or lead salts, injurious to the glaze, shall not be used and the mixture shall have as nearly as possible the same coefficient of expansion as the porcelain.

(e) Finished parts shall conform to dimensions and tolerances shown on Purchaser's drawings.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 75-39.

MECHANICAL INTERLOCKING MACHINE, S. & F. LOCKING

Official Approval

May 1920, July 1927, July 1930, Aug. 1936, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a mechanical interlocking machine, S. & F. locking, for the control of signals, switches, and other interlocking units. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Machine shall conform to the following drawings or references:

1. ....
2. ....

(b) Levers, working and spare, and spare lever spaces shall be:

1. Lever nos. .... working.
2. Lever nos. .... spare.
3. Lever space nos. .... spare.

A.A.R. SIGNAL SECTION SPECIFICATION 114-39.

MECHANICAL INTERLOCKING MACHINE, STYLE "A" LOCKING

Official Approval

Nov. 1921, July 1927, July 1930, Aug. 1936, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a mechanical interlocking machine with Style "A" locking, for the control of signals, switches, and other interlocking units. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Machine shall conform to the following drawings or references:

1. ....
2. ....

(b) Levers, working and spare, and spare lever spaces shall be:

1. Lever nos. ....working.
2. Lever nos...spare.
3. Lever space nos...spare.

A.A.R. SIGNAL SECTION SPECIFICATION 119-39.

WIRING

Official Approval
Nov. 1922, July 1929, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing installation of wire and cable. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material and workmanship meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Clearances.*

(a) Clearances shall conform to clearance diagram recommended by the A.A.R.

7. *General.*

(a) A mandrel of proper cross-section shall be drawn through duct lines to insure that no projections exist and duct lines shall then be cleaned before installing wire or cable.

(b) Wire or cable which may appear damaged, defective or otherwise unsuited for the purpose intended, shall not be installed without authority of the Purchaser.

(c) Wire and cable shall not be removed from coils or reels until ready to be installed.

PRINTED IN U. S. A.

7. *General.*—Continued.

(d) Wire and cable on reels or coils shall be removed in reverse direction of being reeled or coiled and shall not be kinked, twisted or bruised; the insulation shall be kept free from injurious heat, oil, grease or alkalies. Soapstone, flake graphite or other non-injurious compound only shall be used as a pulling lubricant.

(e) Pulling force shall not be employed which may result in stretching, or fail to disclose hard pulling or stalled wire or cable in duct lines.

(f) When more than one wire or cable is placed in same duct or conduit line, they shall be pulled in at one time.

(g) The hitch shall be arranged to equalize the pulling strain, to avoid damage to sheaths or conductors.

(h) When pulling in or laying wire or small cable, a man shall be stationed at each turn in the line.

(i) Slack in wire and cable shall be taken care of in manholes, junction boxes or similar housing, in accordance with Purchaser's requirements.

(j) Wire and cable in manholes or pull boxes shall be supported and fastened to hangers attached to wall.

(k) Wire in trunking, chases or conduits shall be laid loosely without stretching or crowding; a minimum of 25 per cent space for additional wires shall be allowed. *R-7-k.

(l) All wire openings shall be sealed in accordance with Purchaser's requirements.

8. *Wiring.*

(a) Contractor shall install wire and make connections to all apparatus in power plant and interlocking station. The intention of this section is that the Contractor shall do all wiring in connection with the installation. *R-8-a.

(b) Wire within the interlocking station, except cross connections for instruments and interlocking machine, shall be run in the chases or conduit system provided by the Purchaser.

(c) Spare wires shall be installed between stated points as follows:

1. ....
2. ....

(d) Wires between terminals and instruments shall be of sufficient length to allow easy access for inspection of apparatus.

(e) Wiring in signal cases, relay housings, junction and lightning arrester boxes shall be uniform for like apparatus throughout the entire installation.

---

* Alternate requisites section.

8. *Wiring.*—Continued.

(f) Not more than two wires shall be connected to one binding post or terminal screw.

(g) Wire and cable shall be continuous, without joints, between terminals.

(h) Individual cable conductors in housings, when not protected by braid, shall be protected from end of cable covering to eyelet by a fabric sleeve secured with friction tape.

9. *Common return wire.*

(a) When a common return wire is used, it shall be accessible for test at each line break location. *R-9-a.

(b) All connections to common return wire, except line taps, shall be made in terminal boxes.

(c) Length of common return wire shall not exceed 6 miles. *R-9-c.

(d) Common return wire shall be sectionalized wherever practicable.

10. *Wire terminals.*

(a) Eyelet terminals shall be used on flexible wire connections and shall have ends dipped in solder. *R-10-a.

(b) Terminal blocks shall be installed in accessible locations and neatly arranged on terminal boards in shelters. *R-10-b.

11. *Tagging.*

(a) Tags for marking wires shall conform to Drawing 1622.

(b) Wires shall be identified at all terminals by means of a non-metallic tag on which is stamped the designation corresponding to that shown on the circuit and wiring plan. Tags shall be applied in such manner that if a wire is removed from the terminal, the tag will remain on the wire. *R-11-b.

(c) Line wires shall be identified at dead ends and taps by corrosion-resisting metal tags nailed to vertical outer surface of cross-arms below or adjacent to dead ends and taps. *R-11-c.

12. *Line construction.*

(a) Line construction shall be in accordance with Purchaser's Specifications ...., dated ...., and comply with state and local requirements.

(b) Details of line construction shall conform to the following drawings (*R-12-b):

1. Branch Connection to Line Wire Double Cross-Arm Support—Drawing 1403.
2. Branch Connection to Line Wire Single Cross-Arm Support—Drawing 1404.

---

* Alternate requisites section.

12. *Line construction.*—Continued.

3. Branch Connection to Dead-Ended Line Wires Double Cross-Arm Support—Drawing 1411.

4. Purchaser's Drawing ...., dated ....

(c) Wires shall be dead-ended on dead ending insulated shackles. *R-12-c.

(d) Wire or cable drops shall be installed in accordance with Purchaser's requirements.

(e) Aerial cable construction shall be in accordance with Purchaser's Specification ...., dated ....

(f) Aerial cable shall not be drawn through cable hangers.

(g) Aerial cable shall be terminated to conform to Purchaser's Drawing ...., dated ....

13. *Ground wires.*

(a) Grounds shall be installed in accordance with Specification 60. *R-13-a.

14. *Cable for direct earth installation.*

(a) Cable shall be buried to a uniform depth of 2 ft. where practicable. *R-14-a.

(b) Cables in trench shall be surrounded with 4 in. of sand, loam or clay.

(c) Cables passing under or near tracks, when buried less than 2 ft., shall be surrounded with 4 in. of sand, loam or clay and covered with rough 2 in. creosoted plank.

(d) Cables shall be laid loosely in trench and at uniform depth.

(e) Bends in cable shall have a radius of not less than twenty times the diameter of the cable.

(f) Back filling shall be carefully placed to avoid disturbing cable.

(g) Where cable leaves the ground at other than in buildings or foundations it shall be protected by a cast-iron sewer pipe of proper size extending above the ground at least 6 in. and top filled with a sealing compound. *R-14-g.

(h) Cable shall be terminated in accordance with Purchaser's Drawing ...., dated ....

15. *Track circuit bonding.*

(a) Bonding shall be installed in accordance with Specification 135.

---

* Alternate requisites section.

16. *Inspection.*

(a) Purchaser may inspect the installation at all stages to determine that the requirements of this specification have been met.

17. *Tests.*

(a) Contractor shall make such tests as may be necessary to demonstrate to the satisfaction of the Purchaser that the wiring is in accordance with the requirements of this specification. Contractor shall provide such instruments and apparatus as may be necessary for making tests. Instruments and apparatus shall remain the property of the Contractor.

Alternate requisites.

R-7-k.

A minimum of .... per cent space for additional wires shall be allowed.

R-8-a.

Contractor shall install wires and make connections to apparatus in .... and .... The intention of this section is that the Contractor shall do all wiring in connection with the installation of ....

R-9-a.

Common return wire shall be accessible for test at ....

R-9-c.

Length of common return wire shall not exceed .... miles.

R-10-a.

Eyelet terminals shall not be dipped in solder.

R-10-b.

Terminal blocks shall be in accordance with .... They shall be installed as provided in section ....

R-11-b.

Wires shall be identified at all terminals by means of..

R-11-c.

Line wire shall be identified at dead ends and taps by $\left\{\begin{matrix}\text{fibre}\\ \text{..........}\end{matrix}\right\}$ tags nailed to vertical outer surface of cross-arms below or adjacent to dead ends and taps.

Alternate requisites.—Continued.

R-12-b.

Purchaser's Drawings ...., dated ...., shall be substituted for Drawings 1403, 1404 and 1411.

R-12-c.

Wires shall be dead-ended in accordance with Drawing ...., dated ....

R-13-a.

Wire for ground leads of lightning arresters shall be installed as follows: ....

....

R-14-a.

Cable shall be buried to a uniform depth of not less than .... ft.

R-14-g.

Where cable leaves the ground at other than in building or foundations it shall be protected by ....

A.A.R. SIGNAL SECTION SPECIFICATION 76-39.

ELECTRIC INTERLOCKING MACHINE

Official Approval
May 1920, July 1930, Sept. 1932, Aug. 1936, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing an electric interlocking machine for the control of signals, switches, and other interlocking units. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Machine shall conform to the following drawings or references:

1. ....
2. ....

(b) Levers, working and spare, and spare lever spaces shall be:

1. Lever nos.. working.
2. Lever nos.. spare.
3. Lever space nos.. spare.

Alternate requisites.—Continued.

R-9-c.

Locks shall be arranged for normal operation at .... volts .... cycles a.c.

R-13-c.

Electric lamps for lever lights shall be .... filament, for normal operation at .... volts, with .... contact .... base and .... bulb.

R-15-a.

Case shall have:

1. Enamel
2. ....
3. ....

} finish and be equipped for..................padlocks.

R-18-a.

Coils and windings shall be of {silk-covered / enameled / ....} wire. Silk-covered wire shall be impregnated. Materials used for impregnation shall be in accordance with {Requisites for Impregnating Compound Treatment of Electrical Windings. / ....} Enameling shall be in accordance with {Specification for Enameled Round Copper Magnet Wire. / ....}

SPECIFICATION FOR GRAY IRON CASTINGS

1939

Official Approval
Dec. 1935, July 1939.

The recommended specification for gray iron castings is current Specification A 48 of the American Society for Testing Materials.

PRINTED IN U. S. A.

SPECIFICATION FOR REFINED IRON BARS

1939

Official Approval
Dec. 1935, Aug. 1938, July 1939.

The recommended specification for refined iron bars is current Specification A 41 of the American Society for Testing Materials.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 51-39.

INCANDESCENT ELECTRIC LAMPS

Official Approval
July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing lamps required to be used generally for railway signal lights. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Definition and standards.*

(a) Class refers to the material of the filament, $\left\{\begin{array}{l}\text{tungsten.}\\ \text{carbon.}\\ \text{..................}\end{array}\right\}$

(b) The values of the electrical units in this specification are those that were in force on January 1, 1912.

(c) Unit of candle power shall be the International Candle as maintained by the Bureau of Standards at Washington, D. C.

(d) The basis of comparison for all lamps shall be total flux expressed in lumens or mean spherical candle power. The candle power referred to in these specifications for each class of lamp shall be the mean horizontal candle power based on initial spherical reduction factors given in table of the schedule for the several classes of lamps.

(e) The number of hours each lamp burns until the candle power has decreased to 80 per cent of its initial value, or until the lamp breaks, if within that period, is known as the test life.

3. *Assembly and construction.*

(a) Lamps shall be of substantial construction, workmanship and finish shall be of good quality and free from defects. Material shall be in accordance with Signal Section, A.A.R. specifications where they apply.

(b) Lamps shall conform to Drawing 1544.

(c) Bulbs shall be uniform in size and shape, clear, clean and free from flaws and blemishes detrimental to service.

(d) These specifications shall not apply to any frosted, etched, or colored lamps, or to lamps other than those with the usual clear glass bulbs, unless otherwise specifically included.

(e) The shell of the base shall be of good quality brass.

(f) Lamps shall have moisture-proof $\left\{\begin{array}{l}\text{Edison}\\ \text{..............}\end{array}\right\}$ screw bases fitted with glass buttons.

A.A.R. SIGNAL SECTION SPECIFICATION 60-39.

INSTALLATION OF MADE GROUND FOR PROTECTION AGAINST ABNORMAL POTENTIALS

Official Approval

Sept. 1931, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a low-resistance path to earth for abnormal potentials. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material and workmanship meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in alternate requisites section 6031 form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Ground element.*

(a) Ground element shall be made of galvanized iron rod in accordance with Drawing 1424. *R-6-a.

(b) Galvanizing shall be in accordance with Specification 29.

---

* Section 6031. Alternate requisites.

A.A.R. SIGNAL SECTION SPECIFICATION 157-39.

ELECTRIC COLOR LIGHT SIGNAL OPERATING MECHANISM, SEARCHLIGHT TYPE

Official Approval

Sept. 1934, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a.c. or d.c. color light signal operating mechanism, searchlight type. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in alternate requisites section 157-34 form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

(b) Metal parts shall be of non-corrosive material or protected against corrosion.

6. *Mounting.*

(a) High signal unit shall be mounted on a bracket for side-of-pole mounting with independent horizontal and vertical adjustments for alignment of the projected beam. *R-6-a.

(b) Dwarf signal unit shall be mounted on a base arranged for bolting to a foundation with means for providing horizontal alignment and also an independent vertical alignment. *R-6-b.

---

* Section 157-34. Alternate requisites.

A.A.R. SIGNAL SECTION SPECIFICATION 52-39.

LOW-VOLTAGE LIGHTNING ARRESTER

Official Approval

Dec. 1935, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a lightning arrester of the indoor type for circuits of first voltage range, d.c., and first and second voltage range, a.c. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *General design.*

(a) Arrester shall be of general design approved by the Purchaser.

(b) Arrester shall be so designed that moisture will not cause appreciable current leakage or interfere with the normal operation of the signal system.

(c) Arrester shall be so designed that the discharge path shall be non-conducting at maximum rated voltage and conducting at not less than 700 volts d.c. *R-6-c.

(d) Arrester shall be so designed that the 60-cycle voltage r.m.s. at which the discharge path becomes conducting shall not vary more than 20 per cent plus or minus from the value specified by the Contractor. *R-6-d.

---

* Alternate requisites section.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 99-39.

ELECTRIC LOCKS

Official Approval

Mar. 1921, July 1929, Sept. 1931, Aug. 1936, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing electric locks for first and second voltage ranges for application to interlocking machines and track switches, as specified in section 6-a. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Lock is to be applied to ....

(b) Lock shall be designed for operation at .... volts d.c. or .... volts, ... cycles a.c.

(c) Lock shall operate satisfactorily when the voltage is reduced to 80 per cent of rated voltage.

(d) Lock shall conform to the following drawings or references:

1. ....
2. ....

Alternate requisites.—Continued.

R-10-c-2-a.

Lock shall be installed so that clearance conforms to..............
....

R-13-a.

Coils and windings shall be of {silk-covered / enameled / ....} wire. Silk-covered wire shall be impregnated. Materials used for impregnation shall be in accordance with {Requisites for Impregnating Compound Treatment of Electrical Windings. / ....} Enameling shall be in accordance with {Specification for Enameled Round Copper Magnet Wire. / ....}

25. *Batteries.*

(a) Batteries shall be in accordance with the following specifications and drawings:

1. Nickel, Iron, Alkaline Storage Battery—Specification 49.
2. Lead Acid Stationary Storage Battery (Plates of Pure Lead)—Specification 58.
3. Lead Type Portable Storage Battery for Signaling—Specification ...., dated ....
4. Lead Acid Stationary Storage Battery (Plates of Alloy Composition)—Specification 158.
5. Lead Acid Stationary Storage Battery (Plates of Composite Structure)—Specification 53.
6. Specification for Electrolyte.
7. Type "A" Copper-Oxide Caustic Soda Primary Cell—Specification 87.
8. Type "B" Copper-Oxide Caustic Soda Primary Cell—Specification 171.
9. Battery Jar (Primary)—Specification 113.
10. Battery Jar (Storage)—Specification ...., dated ....
11. Round Jars and Cover—Drawing 1053.
12. Rectangular Jars and Cover—Drawing 1419.

(b) Jars for caustic soda type of battery shall conform to Drawing ...., dated ....

(c) Signal operating batteries shall consist of .... sets .... cells of .... type .... a.h. capacity.

(d) Switch operating batteries shall consist of .... sets .... cells of .... type .... a.h. capacity.

(e) .... batteries shall consist of .... sets .... cells of .... type .... a.h. capacity.

(f) Track batteries shall be of .... cells of .... type .... a.h. capacity.

(g) Line batteries shall be of .... cells of .... type .... a.h. capacity.

(h) Supports for batteries in control station shall be furnished in place by the .... and shall conform to Drawing ...., dated ....

(i) The initial charge of storage battery shall be conducted by the .... Current at the proper voltage for initial charge shall be provided by ....

(j) The .... shall furnish with each set of .... battery, one hydrometer and one battery thermometer.

(k) Installation of various types of batteries shall be in accordance with the following instructions:

1. Installation, Maintenance and Operation of Lead Acid Type Storage Batteries.

39. *Signals.*—Continued.

(d) Enameled steel signal blades shall conform to Drawings 1548 and 1568. *R-39-d.

(e) Wood signal blades shall conform to Drawing 1065. *R-39-e.

(f) Signals shall be in accordance with the following specifications and drawings, where applicable:

1. Electric Motor Semaphore Signal—Specification 79.
2. Electric Color Light Signal—Specification 80.
3. Electric Position Light Signal—Specification 81.
4. Electric Color Light Signal Operating Mechanism, Searchlight Type—Specification 157.
5. Electric Color Position Light Signal—Specification 162.
6. "U" Bolt and Clamp—Drawing 1083.
7. Filler Block—Drawings 1090, 1091 and 1092.
8. Ladders—Drawings 1365, 1366, 1583, 1619 and 1620.
9. Ladder Foundation—Drawing 1052.
10. Adapter-Base for Ground Mast Bottom Mechanism Signals—Drawing 1387.
11. Base for 4-Inch Mast—Drawing 1449.
12. Details and Assembly of Marker Lights—Drawing 1238.
13. Grade Signal Marker—Drawing 1612.
14. Take Siding Indicator—Dimensions and Lettering—Drawing 1551.

(g) Signals shall be aligned to give the best view to approaching trains as determined by the Purchaser.

(h) Before signals are erected, the Purchaser shall, in the presence of the Contractor's representative, designate the location of each signal.

(i) Signals and fittings not otherwise specified shall be in accordance with Manufacturer's recommended design subject to approval of Purchaser.

40. *Roundels, lenses and glass slides.*

(a) Roundels, lenses and glass slides shall be in accordance with Specification 69 and Drawing 1414.

(b) The following colors shall be used:

	Indication	Color
1.	....	....
2.	....	....

(c) Roundels shall be securely fastened in the spectacles in a manner satisfactory to the Purchaser.

---

* Alternate requisites section.

45. *Signal lighting circuits.*—Continued.

distribution and .... volts .... watt lamps shall be used. *R-45-b.

(c) Where primary battery is used for lighting, voltage regulators shall be used. *R-45-c.

46. *Special circuits.*

(a) Special circuit requirements, in detail, are as follows:

1. ....
2. ....

47. *Wires and cables.*

(a) Wires and cables shall be in accordance with the following specifications (*R-47-a):

1. Specification for Galvanized Copper Bearing Steel Line Wire.
2. Specification for Steel Guy and Messenger Strand.
3. Bare Copper-Covered Steel Line Wire, Thirty Per Cent Conductivity—Specification 167.
4. Bare Copper Alloy Line Wire, Thirty Per Cent Conductivity—Specification 168.
5. Bare Hard-Drawn Copper Line Wire—Specification 169.
6. Weatherproof Covering for Line Wire—Specification 163.
7. Mineral Matter Rubber Compound Insulated Wire—Specification 111.
8. Aerial Aluminum Cable Steel Reinforced—Specification 54.
9. Aerial Braided Cable—Specification 89.
10. Armored Submarine Cable—Specification 90.
11. Lead-Covered Cable—Specification 91.
12. Parkway Cable—Specification 145.
13. Fibrous-Covered Non-Metallic Sheath for Railway Signal Cable—Specification 161.
14. ....
15. ....

48. *Size of wire.*

(a) Wire shall be of sufficient size to permit operation of switch and signal mechanisms in accordance with this specification.

(b) Single-conductor wires external to the control station or instrument housings shall be not smaller than No. 14 A.W.G.

---

* Alternate requisites section.

A.A.R. SIGNAL SECTION SPECIFICATION 150-39.

CENTRALIZED TRAFFIC CONTROL MACHINE

Official Approval
Sept. 1931, Sept. 1934, July 1937, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a machine for the control of signals, switches, and other apparatus of a centralized traffic control system. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings form an essential part of this specification and should contain the following information:

1. Track and signal plan drawn to scale.
2. Plan showing tracks, signals, and indicator lamps to be included on track chart indicator.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Machine shall conform to the following drawings or references:

1. ....
2. ....

(b) Machine shall include the following features:

1. ....

Alternate requisites.—Continued.

R-13-a.

Machine case shall have:

1. Enamel
2. ....
3. ....

finish and equipped for .... padlocks.

R-16-a.

Materials used for impregnation shall be in accordance with {Requisites for Impregnating Compound Treatment of Electrical Windings. / ....} Enameling shall be in accordance with {Specification for Enameled Round Copper Magnet Wire. / ....}

A.A.R. SIGNAL SECTION REQUISITES.

MECHANICALLY LOCKING THE LEVERS OF INTERLOCKING MACHINES

1939

Official Approval
Mar. 1921, July 1927, Sept. 1933, Aug. 1938, July 1939.

1. *Derail and smashboard.*

(a) Locking shall be provided between levers operating derails in conflicting routes. Each derail lever shall lock levers operating trailing switches in the route except those held by locking between switch levers.

(b) Derail and smashboard levers shall lock levers controlling drawbridge locking devices in reversed position, and shall lock bridge-operating machinery so as to be inoperative.

2. *Switch and movable point frog.*

(a) Locking shall be provided between levers operating double (scissors) crossovers and such other switch levers as will not interfere with the flexibility of the operation.

(b) Locking between levers of switches and between levers of switches and movable point frogs, when necessary, shall not prevent releasing of route when electric route locking is used.

3. *Facing point lock.*

(a) Levers operating facing point locks that lock switches only shall lock the switch levers in normal and reversed positions.

(b) Levers operating facing point locks that lock switches and derails in combination shall lock the switch and derail levers in normal and reversed positions.

(c) Levers operating facing point locks that lock derails only shall lock the derail levers in reversed position.

4. *Signal.*

(a) Signal lever for the route shall lock smashboard levers in reversed position, facing point lock levers in reversed position (except those locked by switch or derail levers), switch levers in proper position (except when so locked by facing point lock levers), and conflicting derail and signal levers in the normal position when not otherwise so locked.

(b) When local conditions require, where switches for diverging moves and main track derails are located in close proximity to and are in the route approaching a signal, the signal lever shall lock these switch and derail levers in the position insuring that these switches and derails are set properly for the route leading to the signal.

PRINTED IN U. S. A.

4. *Signal.*—Continued.

(c) When local conditions require, locking shall be provided between levers operating opposing signals.

(d) Locking shall be provided between the levers operating conflicting signals at cabin door lock and part-time interlockings.

(e) Where a separate approach signal lever is used, it shall lock the home signal lever reversed.

5. *Traffic.*

(a) Power interlocking machine traffic lever controlling movements within an interlocking shall, where practicable, be locked in a position corresponding to the direction in which traffic is established.

(b) Power interlocking machine traffic lever controlling movements between interlockings shall be locked in a position corresponding to the direction in which traffic is established for movement toward the other interlocking.

A.A.R. SIGNAL SECTION SPECIFICATION 160-39.

CAPACITOR FOR POWER FACTOR CORRECTION

Official Approval
Dec. 1935, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a capacitor for power factor correction of railway signal power distribution circuits. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Type.*

(a) Capacitor shall be designed for indoor or outdoor service as specified.

(b) Capacitor shall be equipped with suitable hangers or feet for cross-arm, wall or shelf mounting as specified.

7. *Rating.*

(a) Capacitor shall have a continuous volt-ampere rating at the voltage and frequency specified for operation in an ambient temperature not to exceed 150 deg. F.

(b) Capacitor shall have standard voltage rating of 115, 230, 460, 575, 2300, 4000, 4600 or 6600 volts at a frequency of 60 cycles and shall be capable of operating continuously at 10 per cent above the rated voltage.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 154-39.

TRACTIVE ARMATURE DIRECT CURRENT NEUTRAL RELAY FOR SERIES LINE APPROACH LIGHTING

Official Approval
Sept. 1932, July 1937, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a tractive armature direct current neutral relay, first voltage range, with two contact fingers for series line approach lighting. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Relay shall be of a design approved by the Purchaser.

(b) Relay shall be furnished with two dependent front and back contacts.

(c) All moving parts shall be enclosed in a case which shall be dust and moisture-proof under service conditions. The sides of the case shall be of glass of such transparency that the parts within the case shall be readily visible for inspection. Case shall be so secured that a minimum clearance of ⅛ in. exists between it and all moving parts.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 101-39.

ELECTRIC MOTOR SWITCH OPERATING MECHANISM

Official Approval

Mar. 1921, July 1929, Sept. 1931, Aug. 1936, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing motor-driven mechanism or dual-control mechanism (power or hand-operated) for first and second voltage ranges for operating and locking switches, derails and other movable apparatus. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Power operating requirements.*

(a) Mechanism shall perform its operation in the following sequence:

1. Unlock switch, operate detector bar one-half stroke when bar is used.
2. Operate switch.
3. Lock switch, operate detector bar one-half stroke when bar is used.
4. Indicate.

20. *Warranty.*—Continued.

within one year after shipment to the Purchaser. This warranty shall not apply to any apparatus which shall have been repaired or altered in any way by anyone other than the Manufacturer thereof, so as to affect, in the Contractor's judgment, its proper functioning or reliability, or which has been subject to misuse, negligence or accident.

Alternate requisites.

R-6-h.

The time of operation shall not exceed .... seconds nor shall it exceed .... seconds at a voltage 20 per cent below normal.

R-8-a-3.

Mechanism case shall be provided with cable entrance.

R-8-a-5.

Hand crank shall not be furnished.

R-8-a-7.

Dual-control mechanism shall not be furnished.

R-8-a-11.

Mechanism operating rods shall have maximum stroke of .... in.

R-8-a-12.

Mechanism shall be designed for operation without detector bar. Operating connection shall not be furnished with mechanism, and opening shall be securely closed.

R-8-a-17.

Point detector shall not be furnished.

R-13-a.

Coils and windings shall be of
silk-covered
enameled
....
wire. Silk-covered wire shall be impregnated. Materials used for impregnation shall be in accordance with
Requisites for Impregnating Compound Treatment of Electrical Windings.
....
Enameling shall be in accordance with
Specification for Enameled Round Copper Magnet Wire.
....

A.A.R. SIGNAL SECTION SPECIFICATION 186-39.

TRACTIVE ARMATURE DIRECT CURRENT NEUTRAL INTERLOCKING RELAY

Official Approval
July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a tractive armature direct current neutral interlocking relay, first voltage range. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Relay shall be of a design approved by the Purchaser.

(b) Relay shall consist of two independent magnet structures, coil winding resistance for each to be specified by Purchaser. Each armature shall be furnished with four dependent front and back contacts. *R-6-b.

(c) Interlocking pawl or pawls shall be provided operable by either armature, permitting unrestricted drop-away to full back contact pressure for the first armature de-energized and restriction of the drop-away of the second armature to the interlocked position with all contacts open. *R-6-c.

---

* Alternate requisites section.

PRINTED IN U. S. A.

6. *Design.*—Continued.

(d) Relay shall be so designed that when both sides of the relay are de-energized simultaneously at least one armature shall have full stroke and close its back contacts.

(e) The design of the interlocking mechanism shall be such as to prevent release of the armature from the interlocked position by vibration ordinarily encountered.

(f) The interlocking pawl or pawls shall be restored automatically to the neutral operating position upon energization of both sides of relay, but shall not be affected when first armature is energized while second armature is in the interlocked position.

(g) All moving parts shall be enclosed in a case which, with the exception of the screened breather in the bottom provided by section 6-h, shall be dust and moisture-proof under service conditions. The sides of the case shall be of glass of such transparency that the parts within the case shall be readily visible for inspection. Case shall be so secured that a minimum clearance of $\frac{1}{8}$ in. exists between it and all moving parts. If metal corner posts are used, they shall be so constructed as to securely hold the glass sides and adequately support the top.

(h) When a breather opening, in base of case, is provided it shall be screened and adaptable for closing.

(i) All nuts and screws shall be securely locked.

(j) Each relay shall be equipped with shock absorbing spring supports.

(k) The outside dimensions of relay, equipped with shock absorber springs, shall not exceed the following:

1. Height, $9\frac{3}{4}$ in.
2. Width, $12\frac{3}{4}$ in.
3. Depth, $7\frac{11}{16}$ in.

(l) Contact elements shall be so secured or designed that they cannot be damaged or lose adjustment during shipment.

7. *Mounting.*

(a) The top plate shall be of brown bakelite, which shall have adequate mechanical and dielectric strength and insulating qualities. Bosses shall be provided on the upper side of the top plate for all openings through it and properly proportioned for the binding post, screw or other device to prevent seepage into the relay.

(b) The cores, armature supports and interlocking mechanism supports shall be so mounted that their position relative to each other and to the stationary parts of the contacts shall be maintained.

7. *Mounting.*—Continued.

(c) The parts mounted on the top plate shall be sealed to prevent moisture entering the enclosure containing the moving parts. The compound used shall be in accordance with Specification 177.

8. *Armature supports.*

(a) The end play of the armature shall be not less than 0.010 in. and not more than 0.020 in.

(b) Trunnions and bearings for armature shall fit rigidly in their supports and be suitably secured and constructed so that they cannot exert pressure on the armature.

(c) Armature trunnions shall be hard-drawn bronze or nickel-silver not less than 18 per cent nickel. They shall be cylindrical, not less than 1/16 inch in diameter and 3/32 in. long.

(d) Armature bearings shall be of different material than the trunnions, either hard brass, hard-drawn bronze, or nickel-silver, not less than 18 per cent nickel. They shall be cylindrical and provide for bearing surface not less than 1/16 in. nor more than 3/32 inch in length at each end of each armature. They shall be not less than 0.001 in. nor more than 0.004 in. larger in diameter than the trunnion.

9. *Air gap.*

(a) Minimum physical air gap of 0.013 in. must be provided by hard-drawn bronze stop pin or pins approximately 1/8 inch in diameter. The position with relation to the cores must be so fixed and located that the stop or stops engage either the core or the armature near the edge farthest from and symmetrical with the bearings. If the armature trunnions are adjustable, the stop or stops must engage the armature or core not less than 1/32 in. nor more than 1/4 in. from the edge farthest from the bearings. *R-9-a.

(b) Non-adjustable safety stop pins shall be provided, protruding not less than 0.010 in. from the upper side of armature and so located as to prevent the possibility of the armature coming closer than 0.010 in. to the core faces at any point.

10. *Coils.*

(a) Coils shall be so made that they may be replaced without changing the magnetic and mechanical adjustment of the relay. When in place the coils shall be secured to prevent their movements by vibration with respect to the cores.

(b) Coils shall be so insulated that they will withstand the insulation test provided in section 15. This test shall be made

---

* Alternate requisites section.

PRINTED IN U. S. A.

10. *Coils.*—Continued.

by mounting coil on a snugly fit metal mandrel and making breakdown test between mandrel and winding; also, by standing coil on each end in turn on a metal plate and testing between plate and winding.

(c) Wire for coils shall be soft-drawn copper covered with good quality silk, cotton or enamel insulation in accordance with Specification for Enameled Round Copper Magnet Wire, or with equally good insulation.

(d) When enamel insulation on No. 16 A.W.G. wire or smaller is used, a cotton thread shall be placed between layers and built up at each end to a minimum wall thickness of 1/16 in.

(e) Coils shall be thoroughly dried in a vacuum and impregnated under pressure in such a manner as to completely fill all interstices and effectively seal against the entrance of moisture. Impregnating compound shall be in accordance with Requisites for Impregnating Compound Treatment of Electrical Windings.

(f) Insulating material used for fillers in winding coils shall be chemically neutral.

(g) Connecting terminals of coils shall be joined either by a 14-24 or 10-32 binding post. Terminal leads of coils shall be of strands of tinned copper not larger than No. 28 A.W.G. wire. The aggregate cross-section of the strands shall at least equal that of a No. 18 A.W.G. wire. Leads shall be soldered to coil terminal wires with non-corrosive type flux and shall be so insulated that they will withstand the insulation test provided in section 15.

(h) The coil terminal wires from the ends of the coils closest to the cores shall be connected to the control binding posts.

(i) Coils shall be protected in a suitable manner from mechanical injury.

(j) At 68 deg. F. the percentage of variation in the resistance of individual coils shall not exceed:

1. For 5 ohms or less, plus or minus 5 per cent.
2. Above 5 ohms, plus or minus 10 per cent.

(k) Each coil shall be plainly and permanently marked showing the Manufacturer's reference, nominal resistance, number of turns, size of wire and kind of wire insulation on a tag of non-conducting material adjacent to the outside lead.

(l) All coils must be full wound and the number of turns must not be permitted to vary more than 5 per cent, plus or minus, for any given coil. If a resistance above 5 ohms is specified which cannot be obtained with standard A.W.G. wire, using full-wound coils, the Manufacturer may furnish the nearest resistance to this value, using full-wound coils with standard A.W.G. wire.

11. *Contacts.*

(a) Contact elements shall be so secured that they will not shift nor become loose in shipment or service.

(b) Material used in affixing contact elements must not cause corrosion.

(c) Metal support of the non-fusible contact elements shall not come within 1/16 in. of the contact surface.

(d) Contacts of the carbon to metal type shall be so designed that they cannot be mechanically locked or fused by lightning or by abnormal flow of current in service.

(e) For front contacts of the carbon to metal type, the resistance of the contacts shall not in 100,000 operations (when operating 10 times per minute) average more than 0.18 ohm per contact when the relay is energized at "working current" and when not breaking current, or when breaking non-inductive tungsten lamp load of 4 amperes first voltage range. The contact resistance shall be determined by taking at least 20 readings on each contact of the relay at intervals of 5,000 operations during the test. The average of all readings shall be considered the contact resistance. The initial cleaned contact resistance shall not exceed 0.09 ohm per contact when relay is energized at "working current." Each contact shall be designed to carry 4 amperes continuously.

(f) Contacts for the carbon to metal combination shall be so formed that either a flat or convex surface shall come in contact with the carbon element.

(g) For contacts of the metal to metal type, the initial cleaned contact resistance shall not exceed 0.03 ohm per contact. Each contact shall be designed to carry 4 amperes continuously. *R-11-g.

(h) Contact fingers shall be made of such material and so proportioned that they will not flex appreciably under operating conditions.

(i) The front contact opening when armature is not restricted by interlocking pawl shall in no case be less than 0.050 in. and with front contact just closed the back contact opening shall in no case be less than 0.020 in.

(j) When the armature is restricted by interlocking pawl the minimum front contact opening shall be 0.030 in. and the minimum back contact opening shall be 0.020 in. except for special contacts which remain closed in this position of the armature.

---

* Alternate requisites section.

12. *Interlocking mechanism.*

(a) Locking pawls, bearings, trunnions and stops shall be of phosphor bronze, nickel-silver containing not less than 18 per cent nickel, brass or equivalent corrosion-resisting material.

(b) Each locking pawl shall have at least 0.005 in. end play and sufficient side play on its trunnions to insure perfect freedom of operation.

(c) With either armature energized, the locking pawl for the other armature shall release from the locking position before the armature closes its standard front contacts while picking up. The pawl shall have positive gravity release to move it to its free position.

(d) The first armature to release shall drive the locking pawl into the locking position for the second armature when its energy level is reduced to the release point.

13. *Flexible connections.*

(a) The flexible conductor connecting the binding post and contact finger shall be so formed and attached as not to affect the torque of the armature. This conductor shall be of a section to carry 10 amperes continuously without injury.

14. *Binding posts.*

(a) Binding posts, nuts and washers shall conform to detail 107010, Drawing 1070. *R-14-a.

(b) Material for binding posts shall be brass and shall meet the physical requirements shown on Drawing 1070. *R-14-b.

(c) Material for nuts shall be brass and shall meet the requirements shown on Drawing 1070. *R-14-c.

(d) Material for washers shall be brass and shall meet the requirements shown on Drawing 1070. *R-14-d.

(e) Binding posts shall be mounted so they cannot be turned in the base or frame to which applied, properly insulated.

(f) Binding posts supporting the fixed parts of front and back contacts shall be fastened in their supports so as to preclude adjustment of any kind without first breaking the seal of the relay.

(g) Binding posts shall be spaced not less than 1 in. centers.

15. *Dielectric requirements.*

(a) Electrical apparatus assembled shall withstand for one minute an insulation test, at place of manufacture, of 3000 volts a.c. between all parts of electric circuits and other metallic parts insulated therefrom.

(b) A surface leakage distance of not less than ¼ in. shall be provided between any metallic part of the apparatus carrying current and any other metallic part thereof.

---

* Alternate requisites section.

15. *Dielectric requirements.*—Continued.

(c) Material used as insulation for binding posts or contact fingers shall not be appreciably affected by moisture nor by change in temperature between 40 deg. F. below zero and 185 deg. F. above zero. Material other than porcelain shall, when made up in a standard A.S.T.M. test piece 0.125 in. thick by 4 inches in diameter, meet a requirement of 300 volts per mil. Test shall be in accordance with A.S.T.M. current Specification D 48.

16. *Operating characteristics.*

(a) Operating characteristics of each half of relay having 4 contact fingers shall be as shown in the following table:

	Front and back contacts open in interlocked position	
Inch-ounce torque in direction of drop-away	6	
Resistance ohms	2	4
Minimum drop-away without contact pressure	0.022	0.015
Minimum drop-away with contact pressure	0.053	0.037
Maximum pick-up and maximum working amperes	0.110	0.075

Note.—The 2 and 4 ohm resistance is given in order to clearly show the relative energy requirements.

1. To determine the drop-away current without contact pressure the armature shall be brought to the minimum air gap and a current of four times the pick-up current applied to the coils and gradually reduced until the armature drops away.

2. Tests shall be made on each armature of relays that are assembled ready for service as follows (while one armature is being tested, the other must be held in the energized position):

(a) An initial current of four times the pick-up current shall be applied to the coils and then be reduced until the armature drops away. This value shall be termed "drop-away with contact pressure."

(b) The circuit shall then be opened and current again applied to the coils in the same direction and increased until the armature is picked up. This value shall be termed "pick-up."

16. *Operating characteristics.*—Continued.

(c) The current shall then be increased until the armature is against the stop. This value shall be termed "working."

17. *Finish.*

(a) Metal parts shall be protected against corrosion with nickel plating, or the equivalent, except where the metal parts used are inherently resistant to corrosion or such protection may interfere with proper operation of the relay. Zinc or cadmium must not be used within the enclosure of relay or on current-carrying parts.

(b) Material used for protection against corrosion shall neither melt nor flake under ordinary conditions between temperatures of 40 deg. F. below zero and 185 deg. F. above zero.

18. *Sealing and calibration.*

(a) Relay shall be sealed at the factory so that no adjustment can be made without breaking the seal.

(b) The enclosure shall contain in a location where it cannot interfere with the operation of the relay and can be readily seen with the relay in its operating position, the following data:

1. Serial number of relay.
2. Resistance of coils on each half.
3. Drop-away, pick-up, and working of each half.
4. Date tested.
5. Identification of tester.

19. *Name plate.*

(a) Name plate shall be placed in a conspicuous location showing the Manufacturer's name, serial number and resistance of each half of relay and contact post designation as shown on Drawing 1633.

20. *Inspection.*

(a) Purchaser may inspect material at all stages of manufacture.

(b) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(c) If material has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and the Contractor, upon request, shall advise the Purchaser what disposition is to be made of the rejected material. Contractor shall pay all freight charges.

(d) If Purchaser is to make inspection at point of production it shall be so stated.

21. *Tests.*

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Contractor shall give the Purchaser sufficient notice of time when material will be ready for testing.

(c) Contractor shall provide, at point of production, apparatus and labor for making required tests under supervision of the Purchaser.

(d) If tests are to be made at point of production, the Purchaser shall so state and also indicate which of the tests herein specified are to be made and what portion of the material shall be tested.

22. *Packing.*

(a) Material shall be so prepared as to permit convenient handling and to protect against loss or damage during shipment.

23. *Marking.*

(a) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of package.

24. *Warranty.*

(a) Contractor shall warrant the material covered by this specification to be free from defects in material and workmanship under ordinary use and service, his obligation under this warranty being limited to manufacturing, at point of production, any part or parts to replace those which shall be found defective within one year after shipment to the Purchaser. This warranty shall not apply to any apparatus which shall have been repaired or altered in any way by anyone other than the Manufacturer thereof, so as to affect, in the Contractor's judgment, its proper functioning or reliability, or which has been subject to misuse, negligence or accident.

Alternate requisites.

R-6-b.

Each armature shall be furnished with { .... dependent / .... } front and back standard / ....special } contacts.

Alternate requisites.—Continued.

R-6-c.

Pawl or pawls to restrict drop-away of second armature to the interlocked position with:

Front contacts Nos. .... open.
Front contacts Nos. .... closed.
Back contacts Nos. .... open.
Back contacts Nos. .... closed.

R-9-a.

Working stop pins to be made of ....

R-11-g.

Each contact shall be designed to carry.................... amperes continuously.

R-14-a.

1. Binding posts, nuts and washers shall conform to detail 10705, Drawing 1070.

2. Binding posts, nuts and washers shall conform to detail 107015, Drawing 1070.

R-14-b.

1. Material for binding posts shall be copper base alloy, high strength, and shall meet the physical requirements shown on Drawing 1070.

2. Material for binding posts shall be nickel base alloy and shall meet the physical requirements shown on Drawing 1070.

R-14-c.

1. Material for nuts shall be copper base alloy and shall meet the requirements shown on Drawing 1070.

2. Material for nuts shall be nickel base alloy and shall meet the requirements shown on Drawing 1070.

R-14-d.

1. Material for washers shall be copper base alloy and shall meet the requirements shown on Drawing 1070.

2. Material for washers shall be nickel base alloy and shall meet the requirements shown on Drawing 1070.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 102-39.

ZERO FAHRENHEIT LUBRICATING OIL

Official Approval
Mar. 1921, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a lubricating oil for signal mechanisms and crossing protection apparatus in territories where the temperature does not fall below zero deg. F. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

Note.—This oil shall not be used on relay or in oil dash pots.

2. *Material.*

(a) Oil shall be pale in color, neutral and free from vegetable or animal oils or fats, alkali or other material which might gum or corrode metals under any condition.

(b) Oil shall conform to the following requirements:

1. Flash. Minimum 305° F. (151.7° C.).
2. Fire. Minimum 345° F. (173.9° C.).
3. Viscosity. 100 sec. minimum to 135 sec. maximum at 100° F. (37.8° C.) on the Saybolt Standard Universal Viscosimeter.
4. Pour 0° F. (—17.8° C.).
5. Moisture. None.
6. Sulphur. Free sulphur—none.
7. Acid. Not more than .03 of 1% calculated as SO_3.

3. *Inspection.*

(a) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(b) If material has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and the Contractor, upon request, shall advise the Purchaser what disposition is to be made of the rejected material. Contractor shall pay all freight charges.

(c) If Purchaser is to make inspection at point of production it shall be so stated.

PRINTED IN U. S. A.

4-e-6-b. *Tests.*—Continued.

neutralized alcohol. The strip shall then be allowed to dry as quickly as possible in the air and dropped into a sample of oil contained in the test tube. About one-half of the length of the copper strip shall be submerged. The test tube shall then be closed with a cork stopper and left to stand for 24 hours at a temperature of approximately 70 deg. F. At the end of this time, the copper strip shall be removed and cleansed with proper solvents, then compared with a similar strip of copper freshly cleaned in alcohol as previously described. No discoloration of the test strip shall be shown by this test.

5. *Marking.*

(a) Detail list of containers, cases or drums and their contents shall be furnished for each shipment. Where carload shipments are made, routing and car identification shall be shown.

(b) Each quart container shall be marked with label as follows:

A.A.R. SIGNAL SECTION SPECIFICATION 102.

ZERO F. LUBRICATING OIL

This oil must not be used for lubricating signal mechanisms or crossing protection apparatus in territories where temperature falls below zero deg. F. This oil must not be used on relays or in oil dash pots.

Furnished by..

(c) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of each container, case or drum.

(d) Where carload shipments are made, each case or drum shall be marked with contents and order number, but address may be omitted.

6. *Packing.*

(a) The oil shall be put up in clean, dry containers of one quart size, provided with a screw top and air-tight gasket, or in steel drums of approximately 50 gallons capacity and shall be so protected as to permit convenient handling and to prevent loss or damage during shipment.

A.A.R. SIGNAL SECTION SPECIFICATION 103-39.

45 DEG. BELOW ZERO FAHRENHEIT LUBRICATING OIL

Official Approval
Mar. 1921, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a lubricating oil for signal mechanisms. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

Note.—This oil shall not be used in oil dash pots.

2. *Material.*

(a) Oil shall be pale in color, neutral and free from vegetable or animal oils and fats, alkali or other material which might gum or corrode metals under any condition.

(b) The oil shall conform to the following requirements:

1. Flash. Minimum 290° F. (143.3° C.).
2. Fire. Minimum 325° F. (162.8° C.).
3. Viscosity. Minimum 80 sec. at 100° F. (37.8° C.) on the Saybolt Standard Universal Viscosimeter.
4. Pour at —45° F. (—42.8° C.).
5. Moisture. None.
6. Sulphur. Free sulphur—None.
7. Acid. Not more than .03 of 1% calculated as SO_3.

3. *Inspection.*

(a) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(b) If material has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and the Contractor, upon request, shall advise the Purchaser what disposition is to be made of the rejected material. Contractor shall pay all freight charges.

(c) If Purchaser is to make inspection at point of production it shall be so stated.

166—1939

PRINTED IN U. S. A.

4-e-6. *Tests.*—Continued.

(b) A clean strip of pure copper ½ in. wide and 4 in. long shall be heated to redness and while red hot, dipped in 95 per cent neutralized alcohol. The strip shall then be allowed to dry as quickly as possible in the air and dropped into a sample of oil contained in the test tube. About one-half of the length of the copper strip shall be submerged. The test tube shall then be closed with a cork stopper and left to stand for 24 hours at a temperature of approximately 70 deg. F. At the end of this time, the copper strip shall be removed and cleansed with proper solvents, then compared with a similar strip of copper freshly cleaned in alcohol as previously described. No discoloration of the test strip shall be shown by this test.

5. *Marking.*

(a) Detail list of containers, cases or drums and their contents shall be furnished for each shipment. Where carload shipments are made, routing and car identification shall be shown.

(b) Each quart container shall be marked with label as follows:

A.A.R. SIGNAL SECTION SPECIFICATION 103.

45° BELOW ZERO F. LUBRICATING OIL

This oil must not be used in oil dash pots.
Furnished by..

(c) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of each container, case or drum.

(d) Where carload shipments are made, each case or drum shall be marked with contents and order number but address may be omitted.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 46-39.

TRANSFORMER OIL

Official Approval
Sept. 1931, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing oil for cooling and insulating oil-immersed, self-cooled transformers. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Material.*

(a) Oil shall be first-class in every respect, of a very pale amber color, and free from water, alkali, free sulphur and free chlorides.

3. *Inspection.*

(a) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(b) If material has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and the Contractor, upon request, shall advise the Purchaser what disposition is to be made of the rejected material. Contractor shall pay all freight charges.

(c) If Purchaser is to make inspection at point of production it shall be so stated.

4. *Tests.**

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Contractor shall give the Purchaser sufficient notice of time when material will be ready for testing.

(c) Contractor shall provide, at point of production, apparatus and labor for making required tests under supervision of the Purchaser.

(d) If tests are to be made at point of production it shall be so stated. Purchaser will distinctly indicate

---

* Tests shall be made in accordance with A.S.T.M. current specification D 117.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 120-39.

PAINT AND PAINTING

Official Approval
Nov. 1922, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing paint and painting. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Tender.*

(a) The tender shall be for material and workmanship meeting the requirements of this specification in its entirety.

3. *General.*

(a) Paint and painting shall conform to the best recognized practice and requirements.*

4. *Material.*

(a) The paint ingredients shall be of highest quality and unadulterated.

5. *Composition.*

(a) Paint shall consist solely of oil, gums, driers and pigment in proper proportions by weight.

6. *Volatile matter.*

(a) The volatile matter for oil paints used for exterior painting shall not exceed 5 per cent of the weight of the paint.

7. *Oil.*

(a) The oil shall be pure refined raw linseed, free from foots and clarified by settling and age.

8. *Drier.*

(a) The drier shall consist of pure turpentine, mineral spirits, or a mixture of the two, as the volatile portion of the drier, together with necessary linseed oil and varnish gums, and shall mix with linseed oil without curdling.

9. *Pigment.*

(a) The pigment must be so finely ground that it will pass the required test.

10. *Color.*

(a) The color of the paint shall be as specified in section 12022-R-10-a.

---

* Section 12022.

A.A.R. SIGNAL SECTION SPECIFICATION 151-39.

PLUG TYPE RAIL BONDS AND TRACK CIRCUIT CONNECTORS

Official Approval

Sept. 1931, Sept. 1933, Aug. 1938, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing plug type rail bonds and track circuit connectors for track circuits where rails do not carry return propulsion current. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Drawings 1631 and 1632 form an essential part hereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) General construction and dimensions of bonds and connectors shall conform to Drawings 1631 and 1632. *R-6-a.

7. *Conductors.*

(a) Conductor of single conductor bond or connector shall be stranded with such a lay that the axial length of each turn of wire will be as shown on Drawing 1631 and shall consist of one of the following (manufacturing tolerances allowed on wire sizes) (*R-7-a):

1. One annealed copper wire surrounded by 6 galvanized steel wires, each wire 0.109 in. diameter.
2. Seven galvanized steel wires, each wire 0.109 in. diameter.

---

* Alternate requisites section.

Association of American Railroads
Signal Section

A.A.R. SIGNAL SECTION SPECIFICATION 122-39.

ONE-INCH WELDED STEEL PIPE

Official Approval
July 1927, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing welded steel pipe for the operation of units mechanically operated. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Drawing 1015 forms an essential part hereof.

3. *Chemical properties.*

(a) The steel shall conform to the following requirements as to chemical composition:

1. Phosphorus, not more than 0.11 per cent.
2. Copper, 0.20 per cent to 0.35 per cent.

4. *Physical properties and tests.*

(a) The steel shall conform to the following minimum requirements as to tensile properties:

1. Tensile strength,	50,000 lbs. per sq. in.
2. Yield point,	30,000 lbs. per sq. in.
3. Elongation in 8 in.,	18 per cent.

(b) The yield point shall be determined by the drop of the beam of the testing machine.

(c) Weights, dimensions and hydrostatic pressure shall be as follows:*

Pipe

External	1.315
Internal	1.047
Thickness	0.134
Weight per ft. (ungalvanized)	1.712
Hydrostatic pressure	700.

Coupling

External	1.750
Length	2.250
Weight	0.688

---

* All weights are nominal and are given in lbs. All dimensions are nominal and are given in inches.

5. *Ends.*

(a) Ends of pipe must be cut square and two holes drilled 0.257 inch in diameter for two ¼ in. rivets on one end only; first rivet hole shall be drilled 2 in. from the end and the second 2 in. from this and at right angles to it.

6. *Threads.*

(a) Each length of pipe shall have a thread 1⅛ in. long, ⅜ in. total taper per ft., 11½ slightly rounded top and bottom "V" threads to the inch. The threaded portion of the pipe shall be of such diameter as to permit the coupling to be screwed on five turns by hand, with a permissible variation of one turn either way.

7. *Couplings.*

(a) Each length of threaded pipe shall be provided with one coupling faced at ends, tapped straight through, having clear cut threads and of such pitch diameter as to make a tight joint. Couplings shall be made of wrought iron or steel.

8. *Plugs.*

(a) Plugs shall be open hearth steel, 10 in. long, $^{31}/_{32}$ inch in diameter, drilled 0.257 inch in diameter, for four ¼ in. rivets spacing to be 1 in., 2 in., 4 in., 2 in. and 1 in., the first and third holes to be in the same plane and the second and fourth holes at right angles thereto.

9. *Rivets.*

(a) Rivets must be made of soft iron or steel ¼ inch in diameter and $1^{11}/_{16}$ in. long and galvanized when specified.

10. *Galvanizing.*

(a) Finished pipe and couplings, when specified, shall be hot galvanized inside and outside. The galvanizing shall be in accordance with Specification 29. The coating on the outside of the pipe shall weigh not less than 2 oz. per square foot of coated surface.

11. *Lengths.*

(a) Pipe shall be in random lengths of 16 to 22 ft. Jointers (which are two pieces coupled together) will be rejected.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 123-39.

ONE-INCH WELDED WROUGHT IRON PIPE

Official Approval
July 1924, Aug. 1936, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing welded wrought iron pipe for the operation of units mechanically operated. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Drawing 1015 forms an essential part hereof.

3. *Material.*

(a) Pipe and couplings shall be made from wrought iron and shall be free from any admixture of iron scrap or steel.

(b) The term "iron scrap" applies to any foreign or purchased scrap, but does not include the Manufacturer's own wrought iron skelp crop ends and finished wrought iron pipe ends.

(c) All wrought iron used in the manufacture of signal pipe and couplings shall be produced in accordance with the following definition for the material: "Wrought iron is a ferrous material, aggregated from a solidifying mass of pasty particles of highly refined metallic iron with which, without subsequent fusion, is incorporated a minutely and uniformly distributed quantity of slag."

4. *Chemical properties.*

(a) Wrought iron shall be in accordance with the following requirement as to chemical composition:

1. Manganese, max., per cent.................................. 0.05.

5. *Physical properties and tests.*

(a) Wrought iron shall be in accordance with the following minimum requirements as to tensile properties:

1. Tensile strength, lb. per sq. in............................ 40,000.
2. Yield point, lb. per sq. in.................................. 24,000.
3. Elongation in 8 in., per cent............................ 12.

(b) The yield point shall be determined by the drop of the beam or halt in the gage of the testing machine. The speed of the cross-head of the machine shall not exceed ¾ in. per minute.

A.A.R. SIGNAL SECTION SPECIFICATION 158-39.

LEAD ACID STATIONARY STORAGE BATTERY

Plates of Alloy Composition Supporting Active Material in Paste Form

Official Approval
Sept. 1934, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a pasted plate lead type stationary storage battery cell in sealed-in glass jar. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

3. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

(b) The capacity shall be designated as "35 A.H.," "50 A.H.," "70 A.H.," "120 A.H." and "160 A.H." These terms shall be understood to signify on an 8-hour basis the capacities thus designated in this specification.

(c) Each cell, unless otherwise specified, shall include the following parts:

1. One positive group consisting of the necessary number of plates assembled with connecting strap and pillar post.
2. One negative group consisting of the necessary number of plates assembled with connecting strap and pillar post.
3. One connecting bolt for each pillar post bolt hole.
4. One set of separators consisting of one wood and one rubber separator between each positive and negative plate.
5. One inter-cell connector.
6. One jar with sealed cover and vent plug.
7. Necessary electrolyte.

4. *Elements.*

(a) Positive plates shall be of pasted type and grids shall be pure lead-antimony alloy not less than ¼ in. thick.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 159-39.

BRASS AND HIGH TENSILE STRENGTH METALS AND ALLOYS FOR BINDING POSTS, MACHINE SCREWS, NUTS, WASHERS, ETC., USED IN SIGNAL APPARATUS

Official Approval
Dec. 1935, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a metal or alloy of a corrosion-resistant nature, and of a tensile and torsion strength, ductility and conductivity suitable for material from which to construct binding posts, nuts, washers or other parts of signal apparatus where such a metal or alloy is applicable. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Tender.*

(a) The tender shall be for material meeting the requirements of this specification in its entirety.

3. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

4. *Design.*

(a) The design of the material shall be such that signal apparatus may be manufactured from same in the most efficient manner and under prescribed methods of manufacture.

(b) Stock for use in automatic screw machines of round or polygonal section shall be in straight lengths.

(c) Round stock for use in processing screws other than those with machined heads and machine-cut threads may be furnished in coils in such a manner that the material is subject to no harmful fibre stress or kinks.

(d) Sheet and strip stock for use in processing stamped or drawn parts shall be furnished flat or in coils as specified. If furnished in coils, the inside diameter of the coils shall be such that the material shall be subject to no harmful fibre stress or kinks.

(e) Material shall be highly resistant to corrosion by atmospheric conditions which prevail on railroads.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 104-39.

AIR-COOLED REACTOR FOR LINE AND TRACK CIRCUITS

Official Approval
March 1921, Sept. 1932, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing an air-cooled reactor for line and track circuits. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in alternate requisites section 10432 form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Reactor shall be of design approved by the Purchaser.

(b) Reactor for outdoor use shall be provided with weatherproof case and cover.

(c) Lugs or other suitable means for fastening reactor to a support shall be provided.

7. *Rating.*

(a) Reactor shall be rated in accordance with its voltage, current and impedance characteristics.

1. Voltage rating shall be the maximum voltage at stated frequency which may be applied to the entire winding.

2. Current rating shall be the maximum current, which entire winding can carry continuously at rated voltage and frequency.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 78-39.

ALTERNATING CURRENT RELAY

Official Approval
May 1920, July 1930, July 1937, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing an alternating current relay for control of signals and interlocking apparatus of first, second or third a.c. voltage range. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Relays shall be of a design approved by the Purchaser.

(b) All moving parts shall be enclosed in a case which, with the exception of the screened breather in the bottom provided by section 6-c, shall be dust and moisture-proof under service conditions. The sides of the case shall be of glass of such transparency that the parts within the case shall be readily visible for inspection. Case shall be so secured that a minimum clearance of ⅛ in. exists between it and all moving parts. If metal corner posts are used, they shall be so constructed as to securely hold the glass sides and adequately support the top.

PRINTED IN U. S. A.

Alternate requisites.—Continued.

pound Treatment of Electrical Windings. Enameling shall be in accordance with Specification for Enameled Round Copper Magnet Wire.

A.A.R. SIGNAL SECTION SPECIFICATION 105-39.

TRACTIVE ARMATURE DIRECT CURRENT NEUTRAL RELAY WITH TWO OR MORE CONTACT FINGERS

Official Approval

Mar. 1921, July 1929, Aug. 1936, July 1937, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a tractive armature direct current neutral relay, first voltage range, with two or more contact fingers. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

Note.—The slower shunting characteristics of track relay of four or more contacts covered by this specification should be recognized.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Relay shall be of a design approved by the Purchaser.

(b) Relay shall be furnished with four dependent front and back contacts. *R-6-b.

(c) All moving parts shall be enclosed in a case which, with the exception of the screened breather in the bottom provided

---

* Alternate requisites section.

A.A.R. SIGNAL SECTION SPECIFICATION 128-39.

MECHANICAL TIME RELEASE

Official Approval

July 1924, July 1929, Sept. 1931, Dec. 1935, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing mechanical apparatus to introduce a time interval in the control of signal and switch circuits and levers of interlocking machines. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Release shall conform to the following drawings or references:

1. ....
2. ....

(b) Release shall be designed for application to interlocking machine as shown on Drawing ...., dated .... *R-6-b.

(c) Release not protected by the interlocking machine case shall be enclosed in a separate substantial case for each release, the door or covering of which shall be equipped with suitable

---

* Alternate requisites section.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 106-39.

RESISTOR

Official Approval
March 1921, July 1928, July 1939.

1. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

2. *Alternates.*

(a) The provisions contained in alternate requisites section 10628 form a part hereof only when substituted for the provisions contained in this specification.

3. *Design.*

(a) Resistor shall be of a design approved by the Purchaser. *R-2-a.

4. *Rating.*

(a) Rating of the resistor shall be as follows:

1. Total resistance of resistor in ohms................................
2. Resistance between taps in ohms................................
3. Minimum resistance which cannot be cut out if resistance is adjustable by slide in ohms................................
4. Continuous capacity in amperes................................

5. *Identification.*

(a) Each resistor shall be permanently marked with the following information:

1. Manufacturer's name.
2. Manufacturer's drawing or other reference number.
3. Resistance in ohms.
4. Continuous capacity in amperes.

6. *Temperature rise.*

(a) Temperature rise of the resistor by a thermometer shall not exceed 135 deg. F. based on a room temperature of 68 deg. F. for continuous operation at the current specified by the Purchaser.

---

* Section 10628. Alternate requisites.

A.A.R. SIGNAL SECTION SPECIFICATION 69-39.

SIGNAL GLASSES

(Exclusive of Kerosene Hand Lantern Globes)

Official Approval
Dec. 1935, Aug. 1938, July 1939.

PART A

1. *Purpose.*

(a) Part A of this specification is for the purpose of defining the minimum values of luminous transmission for signal glasses and the limits of chromaticity for signal colors produced by illuminant-glass combinations.

2. *Scope.*

(a) The specification covers the so-called red, yellow, green, blue, purple, and lunar white colors used in railroad signaling.

3. *Basis.*

(a) The values given in the specifications were derived from spectrophotometric data obtained by the Colorimetry Section, National Bureau of Standards, with defining glasses selected by Committee VI of the Signal Section; these values were computed on the following basis:

1. Observer and coordinate system: 1931 I.C.I. Standard. (See section 4.)
2. Illuminant: Planckian radiator at 2360°K for values of T_{AAR} and T_r/T_w, Planckian radiator at 1900°K (kerosene illuminant) and 2848°K (electric illuminant) for values of x, y and z ($C_2 = 14350$ micron degrees).
3. Angular distribution of illumination: approximately at right angles to the surface of the glass.
4. Angle of view: approximately at right angles to the surface of the glass.

(b) The conditions just specified shall be used in testing glasses for conformity to Parts A and B of this specification, except that with depolished discs the illumination shall be diffuse.

4. *Explanatory.*

(a) Any color can, in general, be adequately specified in terms of three colorimetric quantities. In the case of the signal colors the three quantities adequate for the purpose are two numbers defining the chromaticity of the color (*i.e.*, its hue and saturation) and one number defining the luminous transmission of the glass. Since no two observers would, in general, get the same numbers by direct observation (because of differences in luminosity function and chroma vision) it is desirable

PRINTED IN U. S. A.

PART B

(Specification 69-39)

1. ***Purpose.***

(a) Part B of this specification is for the purpose of defining the maximum deviations from the standard limit glasses, both in transmission and in chromaticity, to be permitted in glasses certified as duplicates of the standard limit glasses.

2. ***Transmission.***

(a) The luminous transmissions on the AAR scale, T_{AAR}, of certified duplicate limit glasses shall be as follows, the illuminant being operated at 2360°K:

Color designation	Light limit	Dark limit
Red	170 ± 15	100 ± 5
Yellow, non-heat-resisting	215 ± 10	160 ± 5
Green, non-heat-resisting	205 ± 10	150 ± 5
Green, disc	190 ± 10	138 ± 5
Blue	130 ± 5	75 ± 3
Purple, kerosene	130 ± 5	73 ± 3
Purple, electric	40 ± 3	30 ± 2
Lunar white, kerosene	122 ± 5	80 ± 4
Lunar white, electric	200 ± 10	147 ± 5

Note.—It may be noted that in some cases a certified dark limit glass may have, in accordance with this table, a value of T_{AAR} slightly less than that given in Parts A and C of this specification; this does not, however, invalidate Parts A and C, which must be met by all glasses to be used in railroad signaling.

(b) In addition, for the blue and purple glasses, the ratio of red to total luminous transmission, T_r/T_w, shall be as follows, the illuminant being operated at 2360°K:

Color designation	Light limit	Dark limit
Blue	0.008 ± 0.001	0.000 to 0.001
Purple, kerosene	0.120 ± 0.010	0.160 ± 0.010
Purple, electric	0.190 ± 0.020	0.220 ± 0.020

3. ***Chromaticity.***

(a) All certified duplicate limit glasses shall pass Part A of this specification with respect to the trichromatic coefficients, x, y and *z*; they must also pass the additional specification given in Table I. In Table I are given first the values of x, y and *z* for the standard limit glass with the specified illuminant, followed by the maximum deviations from these values which are permitted in the certified duplicate glass. However, it is unnecessary to give permissible deviations for more than two of these three coefficients, since the sum of x, y and *z* is always unity.

PART C

(Specification 69-39)

1. ***Purpose.***

(a) Part C of this specification is for the purpose of providing approved colored roundels, lenses, discs, and slides for railroad signaling, to describe the materials, and specify the appliances and appurtenances necessary to make the required tests and inspection. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. ***Materials.***

(a) General.

1. Quality and processing shall be of the best for the purpose. The composition must be durable on prolonged exposure to weather; all glasses shall be uniformly colored, true to size and form, free from any streaks, wrinkles, chips or bubbles that in any way detract from their efficiency or use; flashed glasses will not be accepted.

(b) Design.

1. Roundels.

(a) Roundels shall be of the convex type and be between 0.21 and 0.29 inch in thickness.

2. Polished discs.

(a) Polished discs of 1 in. diameter shall be between 0.059 and 0.065 inch in thickness.

Note.—Discs will be furnished depolished on one side or both sides, if so specified.

3. Slides.

(a) Slides shall be $\left\{\begin{matrix}\text{cut}\\ \text{pressed}\end{matrix}\right\}$ to the size ordered, and be between 0.15 and 0.095 inch in thickness.

4. Lenses.

(a) Lenses shall be polyzonal and may be of the following designs or equivalent, according to requirements:

1. Optical—having a smooth outer surface.
2. Inverted—having a smooth inner surface.
3. Spreadlight—may be either of the optical or inverted design, having cylindrical segments on the smooth surface.
4. Wide angle—(yard service) having a smooth outer surface.
5. Fresnel or multi-fresnel—having a smooth inner surface.

Note.—Plano-convex lenses will have both convex and flat surfaces smooth. Sizes larger than 2 inches in diameter shall have the flat surface polished.

A.A.R. SIGNAL SECTION SPECIFICATION 165-39.

TRACTIVE ARMATURE DIRECT CURRENT POLARIZED RELAY

Official Approval
Aug. 1936, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a tractive armature direct current polarized relay, first voltage range, with four or more neutral contact fingers and two or more polar contact fingers. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Relay shall be of a design approved by the Purchaser.

(b) Relay shall be furnished with four dependent front and back neutral contacts and two dependent normal and reverse polar contacts. *R-6-b.

(c) All moving parts shall be enclosed in a case which, with the exception of the screened breather in the bottom provided by section 6-d, shall be dust and moisture-proof under service

---

* Alternate requisites section.

A.A.R. SIGNAL SECTION SPECIFICATION 166-39.

COPPER-OXIDE RECTIFIERS AND VALVES

Official Approval
Aug. 1936, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing copper-oxide rectifiers for battery charging, direct operation of direct current appliances from an alternating current source of power, or as a valve in suppressing arcs formed at contacts, in prolonging the release period of direct current electromagnetic apparatus, as a snubber or for similar purposes. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

(b) When requested by the Purchaser, the Contractor shall submit a statement of efficiency along with the tender showing the efficiency at one-fourth, one-half, three-fourth and full load.

3. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

4. *Design.*

(a) Rectifier shall be of a design approved by the Purchaser.

(b) The rectifying portion of the rectifier shall consist of one or more copper washers, each having one or more surfaces of cuprous-oxide formed thereon.

(c) The rectifying portion shall be protected against accidental and mechanical damage by a covering which shall provide ample circulation of air from the exterior of the rectifier to the rectifying portion.

(d) Unless otherwise specified the rectifying portion of battery charging and direct operation rectifiers shall be connected into a bridge-type circuit arrangement and shall give full-wave rectification.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 178-39.

WELDED TYPE RAIL HEAD BONDS AND TRACK CIRCUIT CONNECTORS

Official Approval

Aug. 1938, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing welded type rail head bonds and track circuit connectors for track circuits where rails do not carry return propulsion current. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Drawing 1047 forms an essential part hereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) General construction and dimensions of bonds and connectors shall conform to Drawing 1047. *R-6-a.

7. *Conductors.*

(a) The flexible stranded conductors shall be made in rope lay construction consisting of one center strand of 19 wires surrounded by 6 strands of 19 wires each, diameter as specified with commercial tolerances allowed. Make-up of finished cable shall be nominal $\frac{5}{16}$ in. diameter and shall consist of one of the following (*R-7-a):

---

* Alternate requisites section.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 179-39.

MECHANICALLY APPLIED RAIL HEAD TYPE BONDS AND TRACK CIRCUIT CONNECTORS

Official Approval

Aug. 1938, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing mechanically applied rail head type bonds and track circuit connectors for track circuits where rails do not carry return propulsion current. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Drawing 1048 forms an essential part hereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) General construction and dimensions of bonds and connectors shall conform to Drawing 1048. *R-6-a.

7. *Conductors.*

(a) The flexible stranded conductors shall be made in rope lay construction, center strand of 12 to 19 wires, surrounded by 6 strands of 12 to 19 wires each. Make-up of finished cable shall have a maximum nominal diameter of $\frac{7}{32}$ in., finished cable 24 inches in length fitted with suitable terminals for tensile test, and shall have a tensile strength of not less than 1400 lbs.

(b) Hard-drawn copper wire shall meet the requirements of A.S.T.M. current Specification B 1.

---

* Alternate requisite section.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 185-39.

FLASHER RELAY

Official Approval
July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a flasher relay for operation on direct current, first voltage range. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Flasher relay shall be of a design approved by the Purchaser.

(b) Flasher relay shall be furnished with four sets of dependent normal and reverse contacts.

(c) All moving parts shall be enclosed in a case which, with the exception of the screened breather in the bottom provided by section 6-d, shall be dust and moisture-proof under service conditions. The sides of the case shall be of glass of such transparency that the parts within the case shall be readily visible for inspection. Case shall be so secured that a minimum clearance of ⅛ in. exists between it and all moving parts. If metal corner posts are used, they shall be so constructed as to securely hold the glass sides and adequately support the top.

PRINTED IN U. S. A.

6. *Design.*—Continued.

(d) When a breather opening, in base of case, is provided it shall be screened and adaptable for closing.

(e) All nuts and screws shall be securely locked.

(f) The outside dimensions of relays shall not exceed the following:

1. Height, 8⅝ in.
2. Width, 7⅝ in.
3. Depth, 6½ in.

(g) Contact elements shall be so secured or designed that they cannot be damaged or lose adjustment during shipment.

(h) Means shall be provided for adjustment of the timing rate in service without breaking the seal.

7. *Mounting.*

(a) The top plate shall be of brown bakelite, which shall have adequate mechanical and dielectric strength and insulating qualities. Bosses shall be provided on the upper side of the top plate for all openings through it and properly proportioned for the binding post, screw or other device to prevent seepage into the relay.

(b) The cores and armature supports shall be so mounted that the position of the cores relative to each other, to the armature supports, and to the fixed part of the contacts, shall be maintained.

(c) The parts mounted on the top plate shall be sealed to prevent moisture entering the enclosure containing the moving parts. The compound used shall be in accordance with Specification 177.

8. *Armature supports.*

(a) The end play of the armature shall be not less than 0.010 in. and not more than 0.020 in.

(b) Trunnions and bearings for armature shall fit rigidly in their supports and be suitably secured and constructed so that they cannot exert pressure on the armature.

(c) Armature trunnions shall be hardened rust-resisting polished steel. They shall be cylindrical, not less than 0.1 inch in diameter and ⅛ in. long.

(d) Armature bearings shall be either hardened rust-resisting polished steel of different temper than trunnion, or nickel-silver not less than 30 per cent nickel. They shall be cylindrical and provide for bearing surface not less than 3/32 in. nor more than

8. *Armature supports.*—Continued.

⅝₂ inch in length at each end of the armature. They shall be not less than 0.001 in. nor more than 0.004 in. larger in diameter than the trunnion.

9. *Air gap.*

(a) Minimum physical air gap of 0.006 in. shall be provided by stop pin or pins approximately ¼ inch in diameter. Stop pins shall be polished stainless steel coacting with linen base laminated bakelite stop plates or hard-drawn bronze when coacting with pole faces. The position with relation to the cores shall be so fixed and located that the stop or stops engage either the core or the armature near the edge farthest from and symmetrical with the bearing.

10. *Coils.*

(a) Coils shall be so made that they may be replaced without changing the magnetic and mechanical adjustment of the relay. When in place the coils shall be secured to prevent their movement by vibration with respect to the cores.

(b) Coils shall be so insulated that they will withstand the insulation test provided in section 14. This test shall be made by mounting coil on a snugly fit metal mandrel and making breakdown test between mandrel and winding; also, by standing coil on each end in turn on a metal plate and testing between plate and winding.

(c) Wire for coils shall be soft-drawn copper, covered with good quality silk, cotton or enamel insulation in accordance with Specification for Enameled Round Copper Magnet Wire, or with equally good insulation.

(d) When enamel insulation on No. 16 A.W.G. wire or smaller is used, a cotton thread shall be placed between layers and built up at each end to a minimum wall thickness of ¹⁄₁₆ in.

(e) Coils shall be thoroughly dried in a vacuum and impregnated under pressure in such a manner as to completely fill all interstices and effectively seal against the entrance of moisture. Impregnating compound shall be in accordance with Requisites for Impregnating Compound Treatment of Electrical Windings.

(f) Insulating material used for fillers in winding coils shall be chemically neutral.

(g) Connecting terminals of coils shall be joined either by a 14-24 or 10-32 binding post. Terminal leads of coils shall be of strands of tinned copper not larger than No. 28 A.W.G. wire. The aggregate cross-section of the strands shall at least equal that of a No. 18 A.W.G. wire. Leads shall be soldered to coil

PRINTED IN U. S. A.

10. *Coils.*—Continued.

terminal wires with non-corrosive type flux and shall be so insulated that they will withstand the insulation test provided in section 14.

(h) Coils shall be protected in a suitable manner from mechanical injury.

(i) At 68 deg. F. the percentage of variation in the resistance of individual coils shall not exceed:

1. For 5 ohms or less, plus or minus 5 per cent.
2. Above 5 ohms, plus or minus 10 per cent.

(j) Each coil shall be plainly and permanently marked showing the Manufacturer's reference, nominal resistance, number of turns, size of wire and kind of wire insulation on a tag of non-conductive material, adjacent to the outside lead.

(k) All coils must be full wound and the number of turns must not be permitted to vary more than 5 per cent, plus or minus, for any given coil. If a resistance above 5 ohms is specified which cannot be obtained with standard A.W.G. wire, using full-wound coils, the Manufacturer may furnish the nearest resistance to this value, using full-wound coils with standard A.W.G. wire.

11. *Contacts.*

(a) Contact elements shall be so secured that they will not shift nor become loose in shipment or service.

(b) Material used in affixing contact elements must not cause corrosion.

(c) Operating contacts used for the control of the energizing current of the relay shall be positive in their action and be so designed that they cannot in normal operation stop in such position as to prevent the relay from properly performing its function throughout the useful life of the relay.

(d) Contacts shall be designed to open and close a non-inductive tungsten lamp load of 5 amperes a.c. or d.c. first voltage range per contact for 10,000,000 operations without the average resistance per contact exceeding 0.05 ohm. The contact resistance shall be determined by taking not less than 20 readings at intervals of 500,000 operations during the test. The initial cleaned contact resistance shall not exceed 0.03 ohm. All resistance measurements shall be taken with armature energized against stop.

(e) Each contact shall be designed to carry 5 amperes continuously.

(f) The minimum contact opening with the armature fully energized in either position shall be 0.030 in. and with the normal contacts just closed the minimum reverse contact opening shall be 0.018 in.

11. *Contacts.*—Continued.

(g) The relay shall be so designed that upon de-energization one set of lamp contacts will remain closed and the other set remain open.

(h) Contacts controlling the coils of relay shall be provided with suitable device to insure against interference with radio receiving sets. Such radio interference suppressors shall be mounted in such a way that they can be replaced without breaking the seal of the relay.

12. *Flexible connections.*

(a) The flexible conductor connecting the binding post and the contact finger shall be so formed and attached as not to affect the torque of the armature. The conductor shall be of a section to carry 10 amperes continuously without injury.

13. *Binding posts.*

(a) Binding posts, nuts and washers shall conform to detail 107010, Drawing 1070. *R-13-a.

(b) Material for binding posts shall be brass and shall meet the physical requirements shown on Drawing 1070. *R-13-b.

(c) Material for nuts shall be brass and shall meet the requirements shown on Drawing 1070. *R-13-c.

(d) Material for washers shall be brass and shall meet the requirements shown on Drawing 1070. *R-13-d.

(e) Binding posts shall be mounted so they cannot be turned in the base or frame to which applied, properly insulated.

(f) Binding posts supporting the fixed parts of contacts shall be fastened in their supports so as to preclude adjustment of any kind without first breaking the seal of the relay.

(g) Binding posts shall be spaced not less than 1 in. centers.

14. *Dielectric requirements.*

(a) Electrical apparatus assembled shall withstand for one minute an insulation test, at place of manufacture, of 3000 volts a.c. between all parts of electric circuits and other metallic parts insulated therefrom.

(b) A surface leakage distance of not less than ¼ in. shall be provided between any metallic part of the apparatus carrying current and any other metallic part thereof.

(c) Material used as insulation for binding posts or contact fingers shall not be appreciably affected by moisture nor by change in temperature between 40 deg. F. below zero and 185 deg. F. above zero. Material other than porcelain shall, when made up in a standard A.S.T.M. test piece 0.125 in. thick by 4 inches in diameter, meet a requirement of 300 volts per mil. Test shall be in accordance with A.S.T.M. current Specification D 48.

---

* Alternate requisites section.

PRINTED IN U. S. A.

15. *Operating characteristics.*

(a) Flasher relay shall be arranged to cause the contacts to operate not less than 40 nor more than 45 times per minute with energy applied to the coils at rated voltage at 68 deg. F. when new and shall not change to below 30 per minute at 68 deg. F. prior to 10,000,000 operations with rated current broken by each contact.

(b) Timing at rated voltage, plus or minus 20 per cent, shall not go below 30 operations per minute at 40 deg. F. below zero nor exceed 55 operations per minute at 150 deg. F. above zero when new.

(c) The time of closed normal contacts shall be practically the same as the time of closed reverse contacts at rated voltage and at 68 deg. F. and the total time of closed normal and closed reverse contact per cycle shall be not more than 0.02 second less than the total time per cycle.

(d) Operating characteristics shall be as shown in the following table at 68 deg. F.:

Rated relay volts	Maximum volts required for starting	Minimum resistance in ohms
1.2	0.8	4.5
6.0	4.5	185.0
8.0	4.5	200.0
10.0	6.8	400.0
12.0	6.8	500.0

(e) Relay shall start and operate at rated voltage at 68 deg. F. when tilted 20 deg. out of plumb in any direction.

16. *Finish.*

(a) Metal parts shall be protected against corrosion with nickel plating, or the equivalent, except where the parts used are inherently resistant to corrosion or where such protection may interfere with proper operation of the relay. Zinc or cadmium must not be used within the enclosure of relay or on current-carrying parts.

(b) Material used for protection against corrosion shall neither melt nor flake under ordinary conditions between temperatures of 40 deg. F. below zero and 185 deg. F. above zero.

17. *Sealing and calibration.*

(a) Relay shall be sealed at the factory so that no adjustment can be made without breaking the seal, except as provided in section 6-h.

17. *Sealing and calibration.*—Continued.

(b) The enclosure shall contain, in a location where it cannot interfere with the operation of the relay and can be readily seen with the relay in its operating position, the following data:

1. Serial number of relay.
2. Resistance of coils.
3. Normal flashes per minute (section 15-a).
4. Rated volts.
5. Date tested.
6. Identification of tester.

18. *Name plate.*

(a) Name plate shall be placed in a conspicuous location, showing the Manufacturer's name, serial number and resistance of relay and contact post designation as shown on Drawing 1633.

19. *Inspection.*

(a) Purchaser may inspect material at all stages of manufacture.

(b) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(c) If material has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and the Contractor, upon request, shall advise the Purchaser what disposition is to be made of the rejected material. Contractor shall pay all freight charges.

(d) If Purchaser is to make inspection at point of production it shall be so stated.

20. *Tests.*

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Contractor shall give the Purchaser sufficient notice of time when material will be ready for testing.

(c) Contractor shall provide, at point of production, apparatus and labor for making required tests under supervision of the Purchaser.

(d) If tests are to be made at point of production, the Purchaser shall so state and also indicate which of the tests herein specified are to be made and what portion of the material shall be tested.

21. *Packing.*

(a) Material shall be so prepared as to permit convenient handling and to protect against loss or damage during shipment.

PRINTED IN U. S. A.

22. *Marking.*

(a) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of package.

23. *Warranty.*

(a) Contractor shall warrant the material covered by this specification to be free from defects in material and workmanship under ordinary use and service, his obligation under this warranty being limited to manufacturing, at point of production, any part or parts to replace those which shall be found defective within one year after shipment to the Purchaser. This warranty shall not apply to any apparatus which shall have been repaired or altered in any way by anyone other than the Manufacturer thereof, so as to affect, in the Contractor's judgment, its proper functioning or reliability, or which has been subject to misuse, negligence or accident.

Alternate requisites.

R-13-a.

1. Binding posts, nuts and washers shall conform to detail 10705, Drawing 1070.

2. Binding posts, nuts and washers shall conform to detail 107015, Drawing 1070.

R-13-b.

1. Material for binding posts shall be copper base alloy, high strength, and shall meet the physical requirements shown on Drawing 1070.

2. Material for binding posts shall be nickel base alloy and shall meet the physical requirements shown on Drawing 1070.

R-13-c.

1. Material for nuts shall be copper base alloy and shall meet the requirements shown on Drawing 1070.

2. Material for nuts shall be nickel base alloy and shall meet the requirements shown on Drawing 1070.

R-13-d.

1. Material for washers shall be copper base alloy and shall meet the requirements shown on Drawing 1070.

2. Material for washers shall be nickel base alloy and shall meet the requirements shown on Drawing 1070.

A.A.R. SIGNAL SECTION SPECIFICATION 79-39.

ELECTRIC MOTOR SEMAPHORE SIGNAL

Official Approval
May 1920, Sept. 1933, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing an electric motor semaphore signal. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in alternate requisites section 7933 form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Signal masts.*

(a) The general design, dimensions and structure of signal masts for bridge or ground signals with side clamp mechanisms shall conform to Drawing 1035. *R-6-a.

(b) The general design, dimensions and structure of signal masts for base-of-mast mechanisms shall conform to the following Purchaser's drawings:

1. ....
2. ....

(c) Joints in pipe and between pipe and castings shall be weatherproofed and of ample strength to support load.

7. *Bases.*

(a) When signal masts are not provided with base mechanism cases, bases shall conform to the following drawings:

1. Base for Ground Signal Masts—Drawing 1614.
2. Socket Base for Bridge Mast—Drawing 1036.

(b) Base for pipe bracket post shall conform to Drawing ...., dated ....

---

* Section 7933. Alternate requisites.

40. *Insulation.*

(a) Coils and windings shall be of cotton-covered wire impregnated. Materials used for impregnation shall be in accordance with Requisites for Impregnating Compound Treatment of Electrical Windings. *R-40-a.

(b) Material used for insulation shall be such as will not be injuriously affected by atmospheric conditions.

41. *Identification.*

(a) Mechanisms shall be plainly marked with Manufacturer's references.

(b) Magnet coils and resistors shall be plainly marked with Manufacturer's references.

42. *Painting.*

(a) Painting shall be in accordance with Specification 120.

43. *Inspection.*

(a) Purchaser may inspect material at all stages of manufacture.

(b) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(c) If material has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and the Contractor, upon request, shall advise the Purchaser what disposition is to be made of the rejected material. Contractor shall pay all freight charges.

(d) If Purchaser is to make inspection at point of production it shall be so stated.

44. *Tests.*

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Contractor shall give the Purchaser sufficient notice of time when material will be ready for testing.

(c) Contractor shall provide, at point of production, apparatus and labor for making required tests under supervision of the Purchaser.

(d) If tests are to be made at point of production, the Purchaser shall so state and also indicate which of the tests herein specified are to be made and what portion of the material shall be tested.

45. *Packing.*

(a) Material shall be so prepared as to permit convenient handling and to protect against loss or damage during shipment.

---

* Section 7933. Alternate requisites.

7933. *Alternate requisites.*—Continued.

R-33-c-1.

Motor shall be of the commutating type.

R-34-a-5.

Hold clear contacts shall not be furnished.

R-40-a.

Coils and windings shall be of
silk-covered
enameled
....
wire. Silk-covered wire shall be impregnated. Materials used for impregnation shall be in accordance with
Requisites for Impregnating Compound Treatment of Electrical Windings.
....
Enameling shall be in accordance with
Specification for Enameled Round Copper Magnet Wire.
....

A.A.R. SIGNAL SECTION SPECIFICATION 180-39.

CENTRALIZED TRAFFIC CONTROL DETACHABLE TYPE NEUTRAL DIRECT CURRENT RELAY

Official Approval
July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a tractive armature direct current neutral relay for use in communication circuits of centralized traffic control systems and for other non-vital circuits. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

5. *Design.*

(a) Relay shall be of a design approved by the Purchaser.

1. Relay shall be of the quick detachable type.

(b) A typical basic relay structure meeting this specification shall operate its armature through the full stroke to its stop at an energization of not more than 200 ampere turns, when equipped and adjusted as follows:

1. Four dependent front and back contacts.

2. An armature motion to provide for the following contact performance with a minimum physical working air gap of 0.005 in. total.

(a) Not less than 0.025 in. compression on each front and back contact.

(b) Not less than 30 grams total pressure for each contact spring.

(c) Not less than 0.010 in. front or back contact opening when other contact is just closed.

5. *Design.*—Continued.

(c) Relay shall be furnished with contacts as required.

1. All contact springs shall have multiple contact tips.

2. Contact springs shall be split to provide independent action of the multiple contact tips.

3. All free flexible contact members (members not actuated directly by the moving armature) shall be provided with stops.

4. Contacts shall be readily visible and accessible from the front of the relay.

(d) Relay shall be designed to operate at least 36,000,000 times without developing defect, under normal conditions of service and in circuits prescribed by the Manufacturer.

(e) Case shall be provided to adequately protect the relay or relays from dust or mechanical interference and adapted for sealing.

(f) All nuts and screws shall be securely locked.

6. *Mounting.*

(a) Contacts shall be rigidly supported by molding in bakelite.

(b) Molded contact assembly shall be so supported as to preclude becoming loose in service.

(c) Core, armature and fixed contacts shall be so mounted that their proper operative relationship shall be maintained.

7. *Armature supports.*

(a) Armature shall be so mounted as to insure free operation throughout its stroke.

8. *Air gap.*

(a) Where stop pins are required for control of armature air gap they shall be of hard-drawn bronze or bakelite. If bakelite is used it shall be of such composition and proportions as to insure no appreciable change in shape or dimensions under ordinary conditions of moisture or between 40 deg. F. below zero and 185 deg. F. above zero.

9. *Coils.*

(a) Coil shall be so insulated that it will withstand the insulation test provided in section 14. This test shall be made with the coil in place on the relay.

(b) The temperature rise, as measured on the coils, when energized under normal operating conditions, shall not exceed 100 deg. F., determined by resistance method.

9. *Coils.*—Continued.

(c) Wire for coil shall be soft-drawn copper covered with good quality silk, cotton or enamel insulation in accordance with Specification for Enameled Round Copper Magnet Wire, or with equally good insulation.

(d) Insulating material used for fillers in winding coils shall be chemically neutral.

(e) Coil terminals shall be mounted in bakelite and so insulated that they will withstand the insulation tests provided in section 14.

(f) Winding shall be protected in a suitable manner from mechanical injury.

(g) At 68 deg. F. the percentage of variation in resistance of individual coils shall not exceed plus or minus 10 per cent.

(h) Each coil shall be plainly and permanently marked, showing the Manufacturer's reference, nominal resistance, number of turns, size of wire, and kind of wire insulation. Where tag is used, it shall be of non-conductive material. Marking shall be visible when coil is assembled on relay.

10. *Contacts.*

(a) Contact elements shall be so secured that they will not shift nor become loose in shipment or service.

(b) Material used in affixing contact elements must not cause corrosion.

(c) For contacts of the metal to metal type, the initial cleaned contact resistance shall not exceed 0.030 ohm per contact.

11. *Operating characteristics.*

(a) Operating characteristics shall be established by the Manufacturer and data furnished for each relay or assembly of relays as required.

12. *Finish.*

(a) Metal parts shall be protected against corrosion with nickel plating, or the equivalent, except where the parts used are inherently resistant to corrosion or where such protection may interfere with proper operation of the relay. Zinc or cadmium must not be used.

(b) Material used for protection against corrosion shall neither melt nor flake under ordinary conditions between temperatures of 40 deg. F. below zero and 185 deg. F. above zero.

13. *Insulation.*

(a) Material used as insulation, including coil heads, shall be free from warpage or appreciable expansion or contraction

13. *Insulation.*—Continued.

due to moisture or by change in temperature between 40 deg. F. below zero and 185 deg. F. above zero. If molded and other than porcelain, it shall, when made up in a standard A.S.T.M. test piece 0.125 in. thick by 4 inches in diameter, meet a requirement of 300 volts per mil. Test shall be in accordance with A.S.T.M. current Specification D 48.

14. *Dielectric requirements.*

(a) Electrical apparatus assembled shall withstand for one minute an insulation test, at place of manufacture, of 3000 volts a.c. between all parts of electric circuits and other metallic parts insulated therefrom.

(b) A surface leakage distance of not less than ⅛ in. shall be provided between any exposed metallic part of the apparatus carrying current and any other metallic part thereof.

15. *Identification.*

(a) Relay shall be plainly marked with Manufacturer's reference number.

16. *Inspection.*

(a) Purchaser may inspect material at all stages of manufacture.

(b) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(c) If material has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and the Contractor, upon request, shall advise the Purchaser what disposition is to be made of the rejected material. Contractor shall pay all freight charges.

(d) If Purchaser is to make inspection at point of production it shall be so stated.

17. *Tests.*

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Contractor shall give the Purchaser sufficient notice of time when material will be ready for testing.

(c) Contractor shall provide, at point of production, apparatus and labor for making required tests under supervision of the Purchaser.

(d) If tests are to be made at point of production, the Purchaser shall so state and also indicate which of the tests herein specified are to be made and what portion of the material shall be tested.

PRINTED IN U. S. A.

18. *Packing.*

(a) Material shall be so prepared as to permit convenient handling and to protect against loss or damage during shipment.

19. *Marking.*

(a) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of package.

20. *Warranty.*

(a) Contractor shall warrant the material covered by this specification to be free from defects in material and workmanship under ordinary use and service, his obligation under this warranty being limited to manufacturing, at point of production, any part or parts to replace those which shall be found defective within one year after shipment to the Purchaser. This warranty shall not apply to any apparatus which shall have been repaired or altered in any way by anyone other than the Manufacturer thereof, so as to affect, in the Contractor's judgment, its proper functioning or reliability, or which has been subject to misuse, negligence or accident.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 80-39.

ELECTRIC COLOR LIGHT SIGNAL

Official Approval
May 1920, July 1929, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing an electric color light signal. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in alternate requisites section 8029 form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) The general design, dimensions and structure of signal shall be in accordance with the following Purchaser's drawings:

1. Tunnel signal..........................
2. Outdoor signals:
   - (a) Ground signal..
   - (b) Bridge or bracket signal.........................
   - (c) Suspended signal..........................
   - (d) Dwarf signal..........................

A.A.R. SIGNAL SECTION SPECIFICATION 81-39.

ELECTRIC POSITION LIGHT SIGNAL

Official Approval
May 1920, Sept. 1934, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing an electric position light signal. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in alternate requisites section 81-34 form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) The general design, dimensions and structure of signal shall conform to Purchaser's drawings.

(b) Detail design of signal shall be approved by Purchaser.

(c) Like parts of same Manufacturer's apparatus shall be interchangeable.

7. *High signal.*

(a) High signal shall be a combination of lamp units, the main and auxiliary groups of which shall have the units located on an 18 in. radius about a central unit.

(b) Lamp units shall be assembled on a framework to provide the aspects as specified.

(c) Lamp units shall be mounted in such a way that they may be adjusted individually in order to procure the alignment which will provide satisfactory signal indications.

12. *Rectifiers.*—Continued.

2. D.C. volts max. ...., min. ...., amperes max. ...., min. ...., for:

(a) ....

(b) Charging .... cells, type .... storage battery.

(c) Use in multiple with .... cells, ... ampere-hour type .... primary battery.

13. *Foundations.*

(a) Foundations shall conform to Drawing ...., dated ....

(b) Foundations shall be so located as to conform to Drawing ...., dated ....

14. *Concrete.*

(a) Concrete shall be in accordance with Railroad Specification ...., dated ....

15. *Signals.*

(a) Signals shall conform to Drawing 1651, 1652, 1653 or 1654.

16. *Circuits.*

(a) Direct current track circuits shall conform to Requisites for Automatic Block Signaling Circuits.

(b) Installation and operation of track circuits shall conform to A.C. Track Circuit Characteristics and Instructions for the Maintenance and Operation of Alternating Current Track Circuits, or to Instructions for Maintenance and Operation of Direct Current Track Circuits.

17. *Wires and cables.*

(a) Wires and cables shall be in accordance with the following specifications:

1. Specification for Galvanized Copper Bearing Steel Line Wire.

2. Specification for Steel Guy and Messenger Strand.

3. Bare Copper-Covered Steel Line Wire, Thirty Per Cent Conductivity—Specification 167.

4. Bare Hard-Drawn Copper Line Wire—Specification 169.

5. Weatherproof Covering for Line Wire—Specification 163.

6. Mineral Matter Rubber Compound Insulated Wire —Specification 111. *R-17-a-6.

---

* Alternate requisites section.

19. *Wiring.*—Continued.

(c) Rubber-insulated tape shall be in accordance with Specification 56.

(d) Friction tape shall be in accordance with Specification 82.

(e) All wires shall be marked with tags in accordance with Railroad Company's prescribed practice.

20. *Terminal blocks.*

(a) Terminal blocks shall conform to Drawing 1056. *R-20-a.

21. *Fuses.*

(a) Fuses shall be in accordance with Specification 96.

(b) Fuses shall be:

	Type	Voltage	Capacity
1.	....	....	....
2.	....	....	....

22. *Bonding.*

(a) Bonds shall be .... type and bonding installed in accordance with Specification 135. *R-22-a.

23. *Power.*

(a) Two sources of power shall be provided for the operation of each crossing signal. Where commercial power is not available this provision may be accomplished by the use of two batteries with multiple connections between the two batteries.

24. *Batteries.*

(a) Batteries shall be in accordance with the following specifications and drawings:

1. Nickel, Iron, Alkaline Storage Battery—Specification 49.
2. Lead Acid Stationary Storage Battery (Plates of Pure Lead)—Specification 58.
3. Lead Type Portable Storage Battery for Signaling—Specification ...., dated ....
4. Lead Acid Stationary Storage Battery (Plates of Alloy Composition)—Specification 158.
5. Lead Acid Stationary Storage Battery (Plates of Composite Structure)—Specification 53.
6. Specification for Electrolyte.
7. Type "A" Copper-Oxide Caustic Soda Primary Cell—Specification 87.
8. Battery Jar (Primary)—Specification 113.

---

* Alternate requisites section.

A.A.R. SIGNAL SECTION SPECIFICATION 181-39.

PAINT AND PAINTING OF BRAID-COVERED AERIAL WIRES AND CABLES

Cable Paint—Volatile Thinner

Official Approval
July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a cable paint and cable painting to preserve and protect fibrous coverings such as braids, servings, tapes, etc., on wire and cable assemblies in aerial service against deterioration from the effects of weather, moisture, acids, alkalies and gases generally prevalent. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Tender.*

(a) The tender shall be for material and workmanship meeting the requirements of this specification in its entirety.

3. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

4. *Composition.*

(a) Cable paint shall be composed of bituminous materials such as asphalt, gilsonite, or stearine pitch in combination with solvents with or without filler.

(b) The solvent may be in accordance with the Manufacturer's general practice provided it is clearly demonstrated to the satisfaction of the Purchaser that the solvent has no detrimental effect on the fabric covering or rubber insulation on the wire or cable under application or service conditions.

(c) There shall be no free sulphur in the finished product.

(d) Cable paint shall not contain esterified or saponified resin in excess of 10 per cent of the total non-volatile or base material.

(e) The non-volatile portion or base material shall form not less than 47 per cent of the weight of the finished product as delivered to the Purchaser.

(f) Cable paint as delivered to the Purchaser shall be readily stirred to produce a liquid of smooth uniform consistency.

(g) The finished product after storage in container for a period of 60 days or less shall not form a packed layer of concentrated bituminous material in the bottom of the container.

209—1939

PRINTED IN U. S. A.

4. *Composition.*—Continued.

(h) Cable paint furnished under this specification shall not support combustion at a temperature below 500 deg. F. 48 hours after application.

(i) Flash point shall not be below 100 deg. F. by the Tagliabue closed tester.

5. *Properties.*

(a) Cable paint shall provide a protective weatherproof pliable coating on wires and aerial cables, which shall not chip, crack, flow or develop brittleness through exposure to temperature changes met in general service throughout the life of the coating.

(b) It shall be free from substances and ingredients which may in any way be injurious to wire or cable insulation, or cause corrosion of metallic conductors under service conditions.

(c) The consistency and body of the cable paint shall be such that it can be applied readily with a brush, in a single coat of uniform thickness.

(d) After application and drying the cable paint shall not flow nor melt under a temperature less than 160 deg. F.

(e) When applied, the cable paint shall penetrate into the covering fabric sufficiently to provide an effective bond throughout the life of the coating.

6. *Color.*

(a) The color of the cable paint shall be black.

7. *Dielectric strength.*

(a) The dielectric requirements of the cable paint after application and drying shall be not less than 200 volts per mil.

Painting

8. *Cleaning.*

(a) The surface on which cable paint is to be applied shall be thoroughly brushed or wiped clean of all loose dirt or foreign substances.

9. *Application.*

(a) All surfaces to be painted shall be completely covered with a uniform coat. Tape coverings, cable connections, repairs, etc., shall be given especially careful consideration to assure complete and thorough protection.

(b) Cable paint applied to built-up cable shall be thoroughly worked into all interstices between the conductors.

9. *Application.*—Continued.

(c) Where fabric coverings of wires or cables are extremely dry or barren of saturant or finish a second application of cable paint should be made.

(d) Where more than one coat of cable paint is specified, the previous coat shall be allowed not less than 6 hours drying before the next coat is applied.

(e) Unless otherwise specified on the label of container, no painting shall be done when cables are wet.

(f) Whenever possible, painting of cables shall be avoided when outside temperature is 45 deg. F. or lower. If painting at low temperature is unavoidable, enough thinner may be added to the paint to render it usable at low temperature, in accordance with the recommendations of the Manufacturer.

(g) Specification 120 shall be considered a part of this specification and shall govern where applicable.

10. *Inspection.*

(a) Purchaser may inspect material at all stages of manufacture.

(b) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(c) If material has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and the Contractor, upon request, shall advise the Purchaser what disposition is to be made of the rejected material. Contractor shall pay all freight charges.

(d) If Purchaser is to make inspection at point of production it shall be so stated.

11. *Tests.*

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Contractor shall give the Purchaser sufficient notice of time when material will be ready for testing.

(c) Contractor shall provide, at point of production, apparatus and labor for making required tests under supervision of the Purchaser.

(d) If tests are to be made at point of production, the Purchaser shall so state and also indicate which of the tests herein specified are to be made and what portion of the material shall be tested.

(e) Samples of cable paint shall be tested in accordance with A.S.T.M. current Specification D 255 to determine that the requirements of section 4-e of this specification are met.

11. *Tests.*—Continued.

(f) Samples of cable paint shall be tested for flammability to determine that the requirements of section 4-h are met. A piece of pressed asbestos board 6 in. by 6 in. by approximately ¼ in. thick, shall be painted with two coats of cable paint and allowed to dry. Not less than 48 hours after application of the cable paint, it shall be exposed to the flame of a Bunsen burner for one minute. After removal therefrom, the cable paint on the test piece shall not support combustion nor smolder excessively.

(g) Samples of cable paint and Manufacturer's recommended thinner shall be tested in accordance with A.S.T.M. current Specification D 56 to determine that the requirements of section 4-i of this specification are met.

(h) To ensure the requirements of section 5-d of this specification are met, the cable paint shall be subjected to the following dripping test:

1. A 3 ft. length of No. 14 A.W.G. solid copper wire, rubber-insulated and braid-covered, shall be cleaned in accordance with section 8 of this specification and painted with two coats of sample cable paint in accordance with section 9 of this specification.
2. After drying and not less than 48 hours after application of the cable paint, the 3 ft. length of wire shall be cut in lengths of 6 in. and the wire bared for a distance of ¾ in. from each end.
3. The 6 in. specimens, with one end secured in a suitable clamp, are then to be suspended at an angle of 45 deg. in a heated oven equipped with suitable temperature control, which has been heated to 160 deg. F. and the specimens maintained at this temperature for 1 hour. At the end of this time the cable paint shall not have dripped, flowed onto the surface of the lower bared end of conductor, formed globules on the lower side of the specimen, nor bubbles upon its surface.

(i) Samples of cable paint shall be tested in accordance with A S.T.M. current Specification D 115 to determine that the requirements of section 7-a of this specification have been met.

(j) Waiver by the Purchaser of any or all of the tests specified in this specification shall not require acceptance by the Purchaser of cable paint not meeting the requirements of this specification.

12. *Samples.*

(a) Where practicable, cable paint shall be sampled at point of manufacture, and at such time as to allow tests controlling acceptance or rejection to be made in advance of shipment.

12. *Samples.*—Continued.

(b) When impracticable to take sample at point of manufacture sample shall be taken from shipment immediately upon delivery.

(c) Sample of cable paint shall be taken in accordance with the methods specified in A.S.T.M. current Specification D 140.

(d) One sample from each shipment of cable paint shall be deemed sufficient.

13. *Packing.*

(a) Paint shall be furnished in containers or steel drums and shall be so prepared as to permit convenient handling and to protect against loss or damage during shipment.

14. *Marking.*

(a) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of package.

(b) Detail list of loose pieces, containers and their contents shall be furnished for each shipment. Where carload shipments are made, routing and car identification shall be shown.

(c) Where carload shipments are made, name and address of Consignee may be omitted.

15. *Warranty.*

(a) Contractor shall warrant the material covered by this specification to be free from defects in material and workmanship under ordinary use and service, his obligation under this warranty being limited to manufacturing, at point of production, any part or parts to replace those which shall be found defective within one year after shipment to the Purchaser. This warranty shall not apply to any material which has been subjected to misuse, negligence or accident.

A.A.R. SIGNAL SECTION SPECIFICATION 187-39.

PAINT AND PAINTING OF BRAID-COVERED AERIAL WIRES AND CABLES

Cable Paint—Asphalt or Coal Tar Emulsion

Official Approval
July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a cable paint and cable painting to preserve and protect fibrous coverings such as braids, servings, tapes, etc., on wire and cable assemblies in aerial service against deterioration from the effects of weather, moisture, acids, alkalies and gases generally prevalent. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Tender.*

(a) The tender shall be for material and workmanship meeting the requirements of this specification in its entirety.

3. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

4. *Composition.*

(a) Cable paint as required under this specification shall be composed of asphalt or coal tar dispersed in water by means of a suitable dispersing agent, to form an emulsion. The addition of a filler is permissible.

(b) Cable paint shall contain not less than 30 per cent nor more than 40 per cent of water by weight.

(c) There shall be no free sulphur in the finished product.

(d) Cable paint shall not contain esterified or saponified resin in excess of 10 per cent of the total base material.

(e) Cable paint as delivered to the Purchaser shall be readily stirred to produce a liquid or semi-solid of smooth uniform consistency.

(f) When thinning is necessary it shall be accomplished by the addition of clear clean water.

(g) Cable paint shall not clot after dilution by adding half a gallon of water to one gallon of cable paint.

(h) The bituminous particles shall remain in suspension until the paint has been applied and set.

PRINTED IN U. S. A.

4. *Composition.*—Continued.

(i) Cable paint after storage in container for a period of 60 days or less shall not form a packed layer of concentrated bituminous material in the bottom of the container.

(j) Cable paint furnished under this specification shall not support combustion at a temperature below 500 deg. F. 48 hours after application.

5. *Properties.*

(a) Cable paint shall provide a protective weatherproof pliable coating on insulated wires and aerial cables, which shall not chip, crack, flow or develop brittleness through exposure to temperature changes met in general service throughout the life of the coating.

(b) It shall be free from substances and ingredients which may be injurious to wire or cable insulation, or cause corrosion of metallic conductors under service conditions.

(c) The consistency and body of the cable paint shall be such that it can be applied readily with a brush, in a single coat of uniform thickness.

(d) After application and drying the cable paint shall not flow nor melt under a temperature less than 160 deg. F.

(e) After application and drying, when subjected to the action of water for 24 hours, the cable paint shall not re-emulsify nor strip from the insulated wire or cable to which applied.

(f) When applied, the cable paint shall penetrate into the covering fabric sufficiently to provide an effective bond throughout the life of the coating.

(g) Cable paint shall be of such character that it shall not become separated by alternate coolings to a temperature of zero deg. F., and gradually reheated to 70 deg. F. This cycle shall be repeated three times without causing the paint to separate or the emulsion to be broken so that the paint cannot be used.

(h) The reaction of the emulsion to litmus paper shall not be acid.

6. *Color.*

(a) The color of the cable paint shall be black.

7. *Dielectric strength.*

(a) The dielectric requirements of the cable paint after application and thorough drying shall be not less than 200 volts per mil.

Painting

8. *Cleaning.*

(a) The surface on which cable paint is to be applied shall be thoroughly brushed or wiped clean of all loose dirt or foreign substances.

9. *Application.*

(a) All surfaces to be painted shall be completely covered with a uniform coat. Tape coverings, cable connections, repairs, etc., shall be given especially careful consideration to assure complete and thorough protection.

(b) Cable paint applied to built-up cable shall be thoroughly worked into all interstices between the conductors.

(c) Where fabric coverings of wires or cables are extremely dry or barren of saturant or finish an application of cable paint thinned by the addition of clear cold water not exceeding 20 per cent by volume should first be applied to the fabric covering, finishing coat to be of the consistency of the material as supplied or recommended by the Manufacturer.

(d) Where more than one coat of cable paint is specified, the previous coat shall be allowed to become dry before the next coat is applied. When cable paint is dry the dry finger tip pressed firmly against the film and withdrawn shall not cause a separation of the paint from the surface of the wire or cable to which applied.

(e) Painting of wires or cables with cable paint which meets the requirements of this specification shall not be done when outside temperatures are 45 deg. F. or lower.

10. *Inspection.*

(a) Purchaser may inspect material at all stages of manufacture.

(b) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(c) If material has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and the Contractor, upon request, shall advise the Purchaser what disposition is to be made of the rejected material. Contractor shall pay all freight charges.

(d) If Purchaser is to make inspection at point of production it shall be so stated.

11. ***Tests.***

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Contractor shall give the Purchaser sufficient notice of time when material will be ready for testing.

(c) Contractor shall provide, at point of production, apparatus and labor for making required tests under supervision of the Purchaser.

(d) If tests are to be made at point of production, the Purchaser shall so state and also indicate which of the tests herein specified are to be made and what portion of the material shall be tested.

(e) Samples of cable paint shall be tested in accordance with A.S.T.M. current Specification D 255 to determine that the requirements of section 4-b of this specification are met.

(f) Samples of cable paint shall be tested for flammability to determine that the requirements of section 4-j are met. A piece of pressed asbestos board 6 in. by 6 in. by approximately ¼ in. thick, shall be painted with two coats of cable paint and allowed to dry. Not less than 48 hours after application of the cable paint, it shall be exposed to the flame of a Bunsen burner for one minute. After removal therefrom, the cable paint on the test piece shall not support combustion nor smolder excessively.

(g) To ensure the requirements of section 5-d of this specification are met, the cable paint shall be subjected to the following dripping test:

1. A 3 ft. length of No. 14 A.W.G. solid copper wire rubber-insulated and braid-covered, shall be cleaned in accordance with section 8 of this specification and painted with two coats of sample cable paint in accordance with section 9 of this specification.

2. After drying and not less than 48 hours after application of the cable paint, the 3 ft. length of wire shall be cut in lengths of 6 in. and the wire bared for a distance of ¾ in. from each end.

3. The 6 in. specimens, with one end secured in a suitable clamp, are then to be suspended at an angle of 45 deg. in a heated oven equipped with suitable temperature control, which has been heated to 160 deg. F. and the specimens maintained at this temperature for 1 hour. At the end of this time the cable paint shall not have dripped, flowed onto the surface of the lower bared end of conductor, formed globules on the lower side of the specimen, nor bubbles upon its surface.

PRINTED IN U. S. A.

11. *Tests.*—Continued.

(h) Samples of cable paint shall be tested in accordance with A.S.T.M. current Specification D 115, to determine that the requirements of section 7-a of this specification have been met.

(i) Waiver by the Purchaser of any or all of the tests specified in this specification shall not require acceptance by the Purchaser of cable paint not meeting the requirements of this specification.

12. *Samples.*

(a) Where practicable, cable paint shall be sampled at point of manufacture, and at such time as to allow tests controlling acceptance or rejection to be made in advance of shipment.

(b) When impracticable to take sample at point of manufacture sample shall be taken from shipment immediately upon delivery.

(c) Sample of cable paint shall be taken in accordance with the methods specified in A.S.T.M. current Specification D 140.

(d) One sample from each shipment of cable paint shall be deemed sufficient.

13. *Packing.*

(a) Paint shall be furnished in containers or steel drums and shall be so prepared as to permit convenient handling and to protect against loss or damage during shipment.

14. *Marking.*

(a) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of package.

(b) Detail list of loose pieces, containers and their contents shall be furnished for each shipment. Where carload shipments are made, routing and car identification shall be shown.

(c) Where carload shipments are made, name and address of Consignee may be omitted.

15. *Warranty.*

(a) Contractor shall warrant the material covered by this specification to be free from defects in material and workmanship under ordinary use and service, his obligation under this warranty being limited to manufacturing, at point of production, any part or parts to replace those which shall be found defective within one year after shipment to the Purchaser. This warranty shall not apply to any material which has been subjected to misuse, negligence or accident.

A.A.R. SIGNAL SECTION SPECIFICATION 107-39.

SWITCHBOARD

Official Approval
Mar. 1921, Sept. 1933, July 1937, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a switchboard for the control and distribution of electric power. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

(c) Contractor shall, unless provided by Purchaser, submit for approval detail drawings showing schematic arrangement of circuits, over-all dimensions, method of support, arrangement and location of apparatus and fittings.

(d) Contractor shall furnish the following information:

1. Drawing references of all instruments, apparatus, and other accessories.
2. Manipulation chart, when specified by Purchaser.

(e) Upon delivery of switchboard, Contractor shall furnish three print copies of all drawings.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 183-39.

MULTIPLE UNIT TERMINAL BLOCK

Official Approval
July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a multiple unit terminal block. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Drawing 1054 forms an essential part hereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) The outline of the terminal base as shown is for essential dimensions only, other dimensions and shape of base may be varied.

(b) Terminal blocks shall be so shaped that they can be easily separated by sawing or breaking into sections of one or more terminals.

7. *Composition base.*

(a) Base shall be molded phenolic insulation, having the following essential characteristics:

1. Color, black or brown.
2. Tensile strength, not less than 6500 lbs. per sq. in.
3. Impact strength, not less than 0.13 ft. lb.
4. Water absorption gain, not more than 0.5 per cent.

PRINTED IN U. S. A.

8. *Binding posts.*

(a) Binding posts, nuts and washers shall conform to detail 107010, Drawing 1070.

(b) Material for binding posts shall be brass and shall meet the physical requirements shown on Drawing 1070. *R-8-b.

(c) Material for nuts shall be brass and shall meet the requirements shown on Drawing 1070. *R-8-c.

(d) Material for washers shall be brass and shall meet the requirements shown on Drawing 1070. *R-8-d.

(e) Binding posts shall be mounted so they cannot be turned in the base or frame to which applied, properly insulated.

9. *Dielectric requirements.*

(a) Terminal blocks assembled shall withstand for one minute an insulation test, at place of manufacture, of 3000 volts a.c. between all parts of electric circuits and other metallic parts insulated therefrom.

10. *Packing.*

(a) Material shall be so prepared as to permit convenient handling and to protect against loss or damage during shipment.

11. *Marking.*

(a) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of package.

(b) Detail list of loose pieces, containers and their contents shall be furnished for each shipment.

(c) Each 12-way terminal block shall be identified with Manufacturer's name molded into the base.

12. *Warranty.*

(a) Contractor shall warrant the material covered by this specification to be free from defects in material and workmanship under ordinary use and service, his obligation under this warranty being limited to manufacturing, at point of production, any part or parts to replace those which shall be found defective within one year after shipment to the Purchaser. This warranty shall not apply to any apparatus which shall have been repaired or altered in any way by anyone other than the Manufacturer thereof, so as to affect, in the Contractor's judgment, its proper functioning or reliability, or which has been subject to misuse, negligence or accident.

---

* Alternate requisites section.

Alternate requisites.

R-8-b.

1. Material for binding posts shall be copper base alloy, high strength, and shall meet the physical requirements shown on Drawing 1070.

2. Material for binding posts shall be nickel base alloy and shall meet the physical requirements shown on Drawing 1070.

R-8-c.

1. Material for nuts shall be copper base alloy and shall meet the requirements shown on Drawing 1070.

2. Material for nuts shall be nickel base alloy and shall meet the requirements shown on Drawing 1070.

R-8-d.

1. Material for washers shall be copper base alloy and shall meet the requirements shown on Drawing 1070.

2. Material for washers shall be nickel base alloy and shall meet the requirements shown on Drawing 1070.

A.A.R. SIGNAL SECTION REQUISITES.

TRACK WELDING OR HEAT TREATING IN TRACK CIRCUIT TERRITORY

1939

Official Approval
July 1939.

Electric arc welding.

1. Connection for the ground cable shall be applied to the same individual rail or frog on which the welding is being done and as close as possible to the point being welded.

2. Ground cable clamp shall be of the rail base type, equipped with proper screw or screws for securely fastening to the rail and to provide good mechanical and electrical contact of ample carrying capacity to handle operating currents without undue heating.

3. Both cables (electrode and ground) shall be completely insulated throughout their entire length.

4. Whenever the electrode holder is laid down it shall be placed on a piece of insulating material and not allowed to come in contact with any rail, frog, or metallic part connected thereto.

5. No resistance or current limiting device shall be inserted in the ground circuit.

6. Multiple operator welding systems, wherein two or more welding circuits are connected electrically to the same source of supply, shall not be used in track circuit territory.

Electric arc welding and oxygen-acetylene welding or heat treating.

7. When the rail or frog at an insulated joint is to be welded or heat treated the insulated joint should be removed if practicable, first obtaining the permission of the proper signal and track department authorities.

8. If necessary to weld or heat treat with the insulated joint in place, damaged insulations shall be replaced immediately upon completion of operations.

9. Welding or heat treating operations shall not be carried on at more than one insulated joint affecting any one track circuit at one time.

10. Rail bonds which cannot be properly protected during welding or heat treating shall be removed and replaced.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 56-39.

RUBBER INSULATING TAPE

Official Approval
Sept. 1932, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing rubber insulating tape. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Material.*

(a) The tape shall be unvulcanized, shall have a smooth surface and be entirely free from holes. The edges shall be straight, the width even, and when being unwound from the original roll the insulation shall show no tendency to stick to the separator.

(b) The tape shall be made exclusively from pure Up-river, fine Para rubber of best quality, solid waxy hydrocarbons, suitable mineral matter and sulphur, properly and thoroughly mixed. Before being mixed with the other ingredients the rubber shall be thoroughly washed and dried.

(c) Each of the dry mineral matter ingredients shall be thoroughly dried and passed through a sieve having not less than 100 meshes to the inch for the whiting and 60 meshes to the inch for the other ingredients before they are mixed.

(d) The ingredients used in the mixture shall be of a quality here specified and within the proportional limits by weight given in the following table:

Ingredient	Percentage by weight Minimum	Maximum
Up-river, fine Para rubber	30.5	32.
Whiting	--------	30.
Zinc oxide	28.	As desired
Litharge	1.	6.
Sulphur	1.5	2.5
Ozokerite or paraffin	2.	3.

	Chemical composition	Lowest grade acceptable
Whiting	$CaCO_3$	96 per cent pure
Zinc oxide	ZnO	Conforming to A.S.T.M. current Specification D79.

(e) Barytes may be used as a substitute for a part of the whiting and the sulphur so introduced will not be included in the allowable sulphur content.

(f) The manufacturing processes shall be perfected to prevent, as far as possible, excessive working of the rubber.

A.A.R. SIGNAL SECTION SPECIFICATION 146-39.

PIN TYPE PORCELAIN INSULATORS

Official Approval
Sept. 1931, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing pin type porcelain insulators for all voltage ranges, which will afford insulation and mechanical support to conductors, used for transmission and distribution of electricity. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

(b) Material shall be of the best commercial grade so as to provide a homogeneous body or mass, which shall be clean white color, hard, tough, dense and uniform throughout.

(c) Parts shall be reasonably true to shape and free from sharp edges, projections, checks, flaws, cracks, chips, holes, laminations, metallic substances, or other irregularities or defects due to improper or imperfect mechanical treatment, faulty drying or firing, inconsistent with the best commercial manufacture.

(d) Surfaces of insulators shall be glazed except where otherwise specified on drawings. The glaze shall be smooth, bright, firmly adherent, thoroughly vitrified and free from bubbles, cracks, checks, crazing or undissolved particles and shall be continuous over the specified portion of the surface.

Part
163
Official Approval, July 1939.

TABLE I

STRINGING SAGS FOR NEW DOUBLE-BRAIDED, WEATHERPROOF HARD-DRAWN COPPER OR BRONZE LINE WIRES MAXIMUM TENSION NOT TO EXCEED 60 PER CENT OF RATED BREAKING LOAD

Span length, in feet	Temperature in degrees F.							Heavy loading district		Medium loading district	
	100	80	60	40	20	0	—20	Minimum A.W.G. hard-drawn copper	Minimum A.W.G. 30% bronze	Minimum A.W.G. hard-drawn copper	Minimum A.W.G. 30% bronze
	Sag in inches										
70	5.7	4.4	3.4	2.7	2.2	1.8	1.6	9	12	12	12
80	7.4	5.8	4.5	3.5	2.9	2.4	2.0	9	12	12	12
90	9.4	7.3	5.7	4.5	3.6	3.0	2.6	8	12	12	12
100	11.6	9.0	7.0	5.5	4.5	3.7	3.2	8	10	10	12
110	14.0	11.0	8.5	6.7	5.4	4.5	3.9	6	10	10	12
120	16.6	13.0	10.1	7.9	6.4	5.4	4.6	6	10	10	12
130	19.5	15.3	11.8	9.3	7.6	6.3	5.4	6	10	10	12
140	22.6	17.7	13.7	10.8	8.8	7.3	6.3	6	10	9	12
150	26.0	20.3	15.8	12.4	10.1	8.4	7.2	6	9	9	12
175	35.4	27.7	21.5	16.8	13.7	11.4	9.8	4	9	8	12
200	46.2	36.2	28.0	22.0	17.9	14.9	12.8	4	8	8	10
225	58.5	45.8	35.4	27.8	22.6	18.9	16.2	4	6	6	10

Loading districts in accord with A.A.R. Telegraph and Telephone Section district loading map 2299.
Assumed loading in accord with National Electrical Safety Code.

TABLE II

STRINGING SAGS FOR NEW DOUBLE-BRAIDED, WEATHERPROOF HARD-DRAWN COPPER OR BRONZE LINE WIRES
MAXIMUM TENSION NOT TO EXCEED 70 PER CENT OF RATED BREAKING STRENGTH

Span length, in feet	Temperature in degrees F.							Heavy loading district		Medium loading district	
	100	80	60	40	20	0	—20	Minimum A.W.G. hard-drawn copper	Minimum A.W.G. 30% bronze	Minimum A.W.G. hard-drawn copper	Minimum A.W.G. 30% bronze
	Sag in inches										
70	5.7	4.4	3.4	2.7	2.2	1.8	1.6	10	12	12	12
80	7.4	5.8	4.5	3.5	2.9	2.4	2.0	10	12	12	12
90	9.4	7.3	5.7	4.5	3.6	3.0	2.6	9	12	12	12
100	11.6	9.0	7.0	5.5	4.5	3.7	3.2	9	12	12	12
110	14.0	11.0	8.5	6.7	5.4	4.5	3.9	9	12	12	12
120	16.6	13.0	10.1	7.9	6.4	5.4	4.6	9	10	12	12
130	19.5	15.3	11.8	9.3	7.6	6.3	5.4	8	10	12	12
140	22.6	17.7	13.7	10.8	8.8	7.3	6.3	8	10	10	12
150	26.0	20.3	15.8	12.4	10.1	8.4	7.2	8	10	10	12
175	35.4	27.7	21.5	16.8	13.7	11.4	9.8	6	9	10	12
200	46.2	36.2	28.0	22.0	17.9	14.9	12.8	6	9	9	12
225	58.5	45.8	35.4	27.8	22.6	18.9	16.2	4	8	9	12

Loading districts in accord with A.A.R. Telegraph and Telephone Section district loading map 2299.
Assumed loading in accord with National Electrical Safety Code.

TABLE III

STRINGING SAGS FOR NEW DOUBLE-BRAIDED, WEATHERPROOF COPPER-COVERED STEEL LINE WIRE MAXIMUM TENSION NOT TO EXCEED PERCENTAGE OF RATED BREAKING STRENGTH SHOWN

Span length, in feet	Temperature in degrees F.							Heavy loading district		Medium loading district
	100	80	60	40	20	0	—20	Not exceeding 60% load minimum A.W.G.	Not exceeding 70% load minimum A.W.G.	Not exceeding 60% load minimum A.W.G.
	Sag in inches									
70	2.4	2.0	1.7	1.5	1.4	1.2	1.1	12	12	12
80	3.0	2.6	2.3	2.0	1.8	1.6	1.5	12	12	12
90	3.9	3.3	2.9	2.5	2.3	2.1	1.9	12	12	12
100	4.8	4.1	3.6	3.2	2.8	2.5	2.3	12	12	12
110	5.7	4.9	4.4	3.8	3.4	3.1	2.8	12	12	12
120	6.9	5.9	5.1	4.5	4.1	3.7	3.4	10	12	12
130	8.0	6.9	6.0	5.3	4.8	4.3	4.0	10	12	12
140	9.3	8.0	7.0	6.2	5.6	5.0	4.6	10	12	12
150	10.6	9.2	8.0	7.1	6.4	5.8	5.3	10	12	12
175	14.2	12.4	10.9	9.7	8.7	7.9	7.2	10	10	12
200	18.3	16.1	14.2	12.6	11.4	10.3	9.4	10	10	12
225	23.2	20.4	18.0	16.2	14.5	13.2	12.0	9	10	12

Loading districts in accord with A.A.R. Telegraph and Telephone Section district loading map 2299.
Assumed loading in accord with National Electrical Safety Code.

TABLE IV

STRINGING SAGS FOR ALL NEW LINE WIRES
LIGHT LOADING DISTRICT
MAXIMUM TENSION NOT TO EXCEED 60 PER CENT OF RATED BREAKING STRENGTH

Span length, in feet	Temperature in degrees F.					
	110	100	80	60	40	20
	Sag in inches					
80	5.5	5.0	4.2	3.4	2.8	2.4
90	7.0	6.4	5.3	4.3	3.6	3.0
100	8.6	7.9	6.5	5.3	4.4	3.7
110	10.4	9.5	7.8	6.5	5.4	4.5
120	12.4	11.3	9.3	7.7	6.4	5.4
130	14.6	13.3	11.0	9.0	7.5	6.3
140	16.9	15.4	12.7	10.5	8.7	7.3
150	19.4	17.7	14.6	12.0	10.0	8.4
175	26.4	24.0	19.9	16.3	13.6	11.5
200	34.5	31.4	25.9	21.3	17.7	15.0
225	43.6	39.7	32.8	27.0	22.4	18.9
250	53.8	49.1	40.5	33.3	27.7	23.4

Loading districts in accord with A.A.R. Telegraph and Telephone Section district loading map 2299.
Assumed loading in accord with National Electrical Safety Code.

A.A.R. SIGNAL SECTION SPECIFICATION 83-39.

AIR-COOLED TRANSFORMER

Official Approval
May 1920, July 1930, Sept. 1934, Dec. 1935, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing an air-cooled transformer. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in alternate requisites section 83-34 form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Type.*

(a) Transformers shall be air-cooled and designed for indoor or outdoor service as specified.

(b) Transformers shall be designed for cross-arm, wall or shelf mounting as specified.

7. *Windings.*

(a) Track, lighting or rectifier transformers shall have their primaries wound for 57.5 volts or even multiples thereof up to 575 volts. The voltage and frequency shall be specified. The primary shall have a 13 per cent tap to compensate for reduced voltage.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 84-39.

TRANSFORMER, OIL-IMMERSED, SELF-COOLED

Official Approval
May 1920, Sept. 1931, July 1937, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing an oil-immersed, self-cooled transformer. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Type.*

(a) Transformer shall be oil-immersed, self-cooled, and designed for outdoor or manhole service, as specified by Purchaser.

(b) If for outdoor service, transformer shall be designed for pole or platform mounting, as specified by Purchaser.

(c) Transformer may be of core or shell type.

7. *Windings.*

(a) Voltages, regulating taps, kv-a. capacities, power factors and other data regarding the load on the separate windings shall be as specified and shall be consistent so far as possible with A.S.A. Standards.

A.A.R. SIGNAL SECTION SPECIFICATION 57-39.

TRUNKING AND CAPPING

Official Approval
July 1928, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing wood trunking and wood capping to be used as a conduit for insulated wires. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Finish.*

(a) It shall be surfaced on four sides. Side of groove of grooved trunking may be sawed, but bottom shall be knife cut.

3. *Dimensions.*

(a) After surfacing, it shall conform to dimensions shown on Drawings 1176 and 1177. A variation of 1/16 in. either way will be allowed in outside dimensions.

(b) The dimensions of the groove, as shown on Drawing 1176, shall be adhered to as a minimum, and an increase in size of 1/8 in. will be allowed as a maximum.

(c) It shall be furnished in lengths from 8 to 20 ft. Thirty per cent or more shall be in lengths of 16 ft. and longer, and not more than 5 per cent shall be in lengths 10 ft. and less. Odd lengths will be permitted.

4. *General quality.*

(a) Lumber shall be:

1. All heart, except as provided in sections 8-e, 8-f and 9-c of this specification.
2. Free from knot holes.
3. Free from shake, except as provided in sections 8-b and 8-d of this specification.
4. Free from wane.
5. Free from any defects sufficient to impair the strength or prevent the use of any piece for the purpose intended in its full length and width.
6. Free from more than one split in any piece of grooved trunking and this shall not exceed in length the width of the piece.
7. Free from split when used for capping or built-up trunking.

A.A.R. SIGNAL SECTION SPECIFICATION 85-39.

PORTABLE DIRECT CURRENT VOLTMETERS, AMMETERS AND VOLT-AMMETERS

Official Approval
May 1920, Sept. 1933, Aug. 1936, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing portable direct current voltmeters, ammeters and volt-ammeters. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Design.*

(a) Instruments shall be of a design approved by the Purchaser.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

5. *Ranges.*

(a) Instruments shall have all ranges self-contained.

(b) Ranges for all combinations shall be as follows:

1. Voltmeters shall be made with one or more voltage ranges, not exceeding six ranges. Ranges desired shall be specified by the Purchaser. Where more than one range is specified, the higher ranges must be multiples of the lowest range.

2. Ammeters shall be made with one or more ampere ranges, not exceeding six ranges. Ranges desired shall be specified by the Purchaser. Where more than one range is specified, the higher ranges must be multiples of the lowest range.

3. Volt-ammeters shall be made with one or more voltage and ampere ranges, not exceeding six ranges. Ranges desired shall be specified by the Purchaser. The following voltage and ampere ranges shall be used in selecting combinations:

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 115-39.

PORTABLE ALTERNATING CURRENT VOLTMETER

Official Approval
Nov. 1921, July 1928, Dec. 1935, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing a portable alternating current voltmeter. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Design.*

(a) Instrument shall be of a design approved by the Purchaser.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

5. *General.*

(a) Instruments shall be made in five combinations:

1. Combinations Nos. 1-a and 2-a are for use when a relatively high degree of accuracy is desired.

2. Combinations Nos. 1-b, 2-b and 3-a are for use when a less accurate instrument is desired.

6. *Ranges and scales.*

(a) Instruments shall have all ranges self-contained.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 182-39.

WEATHER-RESISTING BRAID COVERINGS FOR AERIAL, RUBBER-INSULATED WIRE AND CABLE

Official Approval
Aug. 1938, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing construction and performance tests for rubber-filled tape and outer cotton braided coverings on aerial, rubber-insulated wire and cable for use on signal circuits rated at 660 volts or less. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

3. *General.*

(a) Single conductor No. 8 A.W.G. and smaller.

1. Protective covering shall consist of one weather-resisting braid unless two weather-resisting braids or one rubber-filled tape and one weather-resisting braid are specified by Purchaser.

(b) Single conductor larger than No. 8 A.W.G.

1. Protective covering shall consist of one rubber-filled tape and one weather-resisting braid unless two weather-resisting braids are specified, in which case these shall be in addition to any tape that is required for vulcanization purposes by Purchaser. *R-3-b-1.

(c) Multiple conductor cable.

1. Protective covering shall consist of one rubber-filled tape over the assembled conductors and one weather-resisting braid overall.

4. *Rubber-filled tape.*

(a) Rubber-filled tape and the method of its application shall conform to the requirements of A.S.T.M. Specification D27-37T (sections 52 to 55, inclusive).

---

* Alternate requisite section.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 168-39.

BARE COPPER ALLOY LINE WIRE, THIRTY PER CENT CONDUCTIVITY

Official Approval
Aug. 1936, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing copper alloy line wire, thirty per cent conductivity, for use either as bare line wire or as the conductor for weatherproof line wire. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Material.*

(a) The wire shall be a hard-drawn copper alloy and shall have the properties herein specified. The copper content shall be at least 94 per cent and the alloy shall be uniform throughout.

3. *Properties.*

(a) Diameter.

1. Each coil shall be gaged at three places, one near each end, one near the middle. The diameter shall be not more than 3 per cent over or 1 per cent under the diameter specified in Table I except that if two points are within the stated limit, the third point may be within 4 per cent over or 2 per cent under.

TABLE I

Size, A.W.G.	Diameter, in.	Breaking load, lb.*	Approximate weight per 1000 ft., lb.	Nominal resistance in ohms per 1000 ft. at 68 deg. F.	Elongation, per cent in 60 in.
4	0.2043	2,917	126.4	0.83	1.24
6	0.1620	1,955	79.5	1.32	1.14
8	0.1285	1,270	50.0	2.09	1.06
9	0.1144	1,018	39.6	2.64	1.02
10	0.1019	816	31.4	3.33	1.00
12	0.0808	524	19.8	5.29	0.95

(b) Electrical conductivity and resistance.

1. The resistivity of the wire at a temperature of 68 deg. F. shall be not greater than 34.57 ohms per cir. mil ft.

---

* The breaking load for weatherproof wire shall be the same as for the bare wire, instead of as specified in Specification 163.

A.A.R. SIGNAL SECTION SPECIFICATION 70-39.

FORTY PER CENT CONDUCTIVITY COPPER-COVERED STEEL BONDING WIRE

Official Approval
Sept. 1932, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing No. 6 A.W.G. copper-covered steel bonding wire for bonding rail joints of steam railroads where track circuits are used. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Conductor.*

(a) The wire shall be composed of a steel core with a copper coat concentrically placed around and permanently welded thereto. The wire must be cylindrical in form and free from scales, flaws, inequalities, splits and all imperfections. The wires shall be cut and straightened to the length specified on order and be thoroughly annealed. The ends shall be sheared-cut and free from burrs.

3. *Properties.*

(a) The mechanical and electrical properties of the finished wire must be in accordance with the following requirements:

A.W.G.	Diameter in mils	Minimum elongation in 10 in.	Ohms per ft. at 68 deg. F. Avg.	Ohms per ft. at 68 deg. F. Max.
6	162 ± 1½%	15%	0.00101	0.00109

(b) The wire during any stage of manufacture when broken by twisting, repeated bending, or by both, shall show no separation of the copper from the steel.

4. *Inspection and tests.*

(a) Purchaser is to have the right to make such tests as required for determining whether the wire meets these specifications.

(b) Manufacturer must provide at the mill all apparatus and labor for making the required tests under the supervision of a representative of the Purchaser.

(c) Tests shall be made at place of manufacture and may also be made on the wire upon its arrival at destination.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 22-39.

GALVANIZED E.B.B. STEEL BONDING WIRE

Official Approval

Sept. 1932, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing No. 8 B.W.G. galvanized steel bonding wire for bonding rail joints of steam railroads where track circuits are used. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Conductor.*

(a) The wire must be cylindrical in form, free from scales, flaws, inequalities, splits and all imperfections. The wires shall be cut and straightened to the length specified on order. The ends shall be sheared-cut and free from burrs.

(b) The galvanizing shall consist of a continuous coating of pure zinc of uniform thickness and so applied that it adheres firmly to the steel and presents a smooth surface.

3. *Properties.*

(a) The mechanical and electrical properties of the finished wire must be in accordance with the following requirements:

B.W.G.	Diameter in mils	Breaking resistance, lb.	Per cent elongation in 10 in.	Resistance in ohms per ft. at 68 deg. F.	
				Avg.	Max.
8	165 ± 1½%	975	15	0.00236	0.00259

4. *Galvanizing test.*

(a) A sufficient number of samples shall be taken from the wire submitted for inspection and shall be tested, these pieces being not less than 8 in. long and not more than seven pieces of wire shall be immersed in the specified quantity of solution.

(b) The samples shall be cleaned before being tested, first with carbona, benzine or turpentine and cotton waste, and then thoroughly rinsed in clear water and wiped dry with clean cotton waste. The samples shall be cleaned and dried before being immersed in the solution. The samples, when placed in the solution, shall be well separated to permit the solution to act uniformly on all immersed portions of the samples.

(c) The samples shall be tested in a neutral solution of commercial copper sulphate having a specific gravity of 1.186 at a temperature of 65 deg. F. The solution shall be neutralized by the addition of excess of chemically pure cupric oxide (CuO), which will collect in the bottom of the containing vessel. The solution shall be filtered before being used. Not less than 4 oz. of fresh solution shall be used for each test of seven wires. The solution must be maintained at a temperature between 62 and

A.R.A. SIGNAL SECTION SPECIFICATION 11033.

WIRE JOINTS

Official Approval
Mar. 1921, Sept. 1933.

1. *General.*

(a) Joints between copper line wires in tension shall be made with a copper tinned sleeve which shall be given three and one-half turns in accordance with Drawing 1407.

(b) Joints between iron line wires in tension shall be made with a steel tinned sleeve, which shall be given three and one-half turns in accordance with Drawing 1407.

(c) Joints between copper or iron line wires and copper branch wires shall be made with a copper tinned sleeve, which shall be given three and one-half turns in accordance with Drawing 1407.

(d) Joints between rubber-insulated wires shall be made in accordance with Drawing 1406.

2. *Tinning.*

(a) Where an iron wire is to be soldered in the form of a joint, it must be tinned before the wires are twisted together.

3. *Soldering.*

(a) Joints shall be soldered by dipping the wires in, or pouring on, the melted solder until there is a metallic union of the wires for the length of the joint. The flux used shall be non-corrosive. After soldering, the joint shall be wiped clean with a piece of dry and clean cloth or waste. Joints shall be soldered the day made.

4. *Insulation and covering.*

(a) Joints shall be insulated and covered in accordance with Drawings 1403, 1404, 1405, 1406, 1407, 1408 and 1411.

(b) Joints shall be dry when insulated and covered.

(c) Joints shall be thickly coated with a rubber cement made of a solution of pure Para rubber dissolved in benzine, having the consistency of mucilage, which shall be allowed to dry for not less than 1 minute. Rubber tape of quality prescribed in Specification 56 shall be wound tightly over the joint in successive layers, overlapping one-half its width. The tape so applied shall be warmed to between 120 and 250 deg. F. by a blow torch, care being used not to burn the insulation. After heating, the insulation shall be firmly pressed together.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 167-39.

BARE COPPER-COVERED STEEL LINE WIRE, THIRTY PER CENT CONDUCTIVITY

Official Approval
Aug. 1936, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing copper-covered steel line wire, 30 per cent conductivity, for use either as bare line wire or as the conductor for weatherproof line wire. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Material.*

(a) The wire shall be composed of a steel core with an outer covering of copper which shall be thoroughly welded thereto, so that an inseparable and interlocking crystalline union is secured between the two metals and shall have the properties herein specified.

3. *Properties.*

(a) Diameter.

1. Each coil shall be gaged at three places, one near each end, one near the middle. The diameter shall be not more than 1½ per cent over or under the diameter specified in Table I except that if two points are within the stated limit, the third point may be within 2 per cent.

TABLE I

Size, A.W.G	Diameter, in.	Breaking load, lb.*	Approximate weight per 1000 ft., lb.	Nominal resistance in ohms per 1000 ft. at 68 deg. F.
4	0.204	3,920	116.0	0.848
6	0.162	2,680	72.8	1.344
8	0.128	1,800	45.5	2.153
9	0.114	1,480	36.1	2.714
10	0.102	1,230	28.9	3.390
12	0.081	770	18.2	5.374

(b) Electrical conductivity and resistance.

1. The electrical resistivity of the wire at a temperature of 68 deg. F. shall not exceed the following limits:

(a) Maximum, average for entire coil, 35.26 ohms per cir. mil ft.

(b) Maximum, for any part of the coil, 39.18 ohms per cir. mil ft.

---

* The breaking load for weatherproof wire shall be the same as for the bare wire, instead of as specified in Specification 163.

PRINTED IN U. S. A.

SPECIFICATION FOR GALVANIZED COPPER BEARING STEEL LINE WIRE

1939

Official Approval
July 1939.

The recommended specification for galvanized copper bearing steel line wire will be found in the Manual of the A.A.R. Telegraph and Telephone Section under the heading "1-A-53."

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 169-39.

BARE HARD-DRAWN COPPER LINE WIRE

Official Approval
Aug. 1936, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing hard-drawn copper line wire for use either as bare line wire or as the conductor for weatherproof line wire. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Material.*

(a) The wire shall be solid hard-drawn copper and shall have the properties herein specified.

3. *Properties.*

(a) Diameter.

1. Each coil shall be gaged at three places, one near each end, one near the middle. The diameter shall be not more than 1 per cent over or under the diameter specified in Table I except that if two points are within the stated limit, the third point may be within 2 per cent.

TABLE I

Size, A.W.G.	Diameter, in.	Breaking load, lb.*	Approximate weight per 1000 ft., lb.	Nominal resistance in ohms per 1000 ft. at 68 deg. F.	Elongation, per cent in 60 in.
4	0.2043	1,970	126.4	0.258	1.24
6	0.1620	1,280	79.5	0.411	1.14
8	0.1285	826	50.0	0.653	1.06
9	0.1144	661	39.6	0.821	1.02
10	0.1019	529	31.4	1.039	1.00

(b) Electrical conductivity and resistance.

1. The electrical resistivity of the wire shall be determined by resistance measurement referred to a temperature of 68 deg. F. The resistivity of the wire shall not exceed 10.785 ohms per cir. mil ft.

(c) Breaking load.

1. The bare wire shall have a breaking load at least equal to the value stated in Table I. If upon testing a sample from any coil of wire, the results are found to be below the value stated in the table, tests on two additional samples

---

* The breaking load of the weatherproof wire shall be as specified in Specification 163.

SPECIFICATION FOR ENAMELED ROUND COPPER MAGNET WIRE

1939

Official Approval
July 1939.

The recommended specification for enameled round copper magnet wire is Standard C8.7 of the American Standards Association.

PRINTED IN U. S. A.

SPECIFICATION FOR STEEL GUY AND MESSENGER STRAND

1939

Official Approval
July 1939.

The recommended specification for steel guy and messenger strand will be found in the Manual of the A.A.R. Telegraph and Telephone Section under the heading "1-A-17."

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION SPECIFICATION 111-39.

MINERAL MATTER RUBBER COMPOUND INSULATED WIRE

Official Approval

March 1921, July 1929, Sept. 1932, Sept. 1933, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing mineral matter rubber compound insulated wire for 660 volts or less. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Conductors.*

(a) Conductors must be of soft-drawn, annealed copper wire having a conductivity of not less than 98 per cent of Annealed Copper Standard. Each wire forming a conductor must be continuous without weld, splice or joint throughout its length, must be uniform in cross-section, free from flaws, scales or other imperfections and provided with a heavy uniform coating of tin.

3. *Workmanship.*

(a) General.

1. The insulation shall consist of a properly vulcanized rubber compound which shall be homogeneous in character, tough, elastic and applied concentrically about the conductor and shall fit tightly thereto. Where the insulation is applied in more than one layer, adjacent layers shall be vulcanized into a homogeneous mass.

(b) Repairs and joints.

1. Where repairs of joints are made in the insulation, the work shall be done in such manner that the repaired part of joint, and all parts affected in the process, shall be as strong and durable electrically and mechanically as the remainder of the insulation and shall not exceed the diameter limitations imposed by sections 5 and 9-a.

4. *Composition.*

(a) General.

1. The insulation shall contain exclusively the best quality pure Up-river, fine dry Para rubber which has not previously been used in a rubber compound, solid waxy

A.A.R. SIGNAL SECTION SPECIFICATION 134-39.

ELECTRO-MECHANICAL INTERLOCKING MACHINE

Official Approval

July 1925, July 1930, Sept. 1933, Aug. 1938, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing an interlocking machine for the control of signals, switches and other interlocking units. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Machine shall be so designed that additional lever sections may be added on either end and conform to the following drawings or references:

1. Unit electric levers, mechanical locking..........................
2. Mechanical miniature locking..
3. ....

(b) Levers, working and spare, and spare lever spaces shall be:

1. Mechanical levers nos...working.

PRINTED IN U. S. A.

Alternate requisites.—Continued.

R-18-a.

Coils and windings shall be of $\left\{\begin{array}{l}\text{silk-covered}\\ \text{enameled}\\ \text{..................}\end{array}\right\}$ wire. Silk-covered wire shall be impregnated. Materials used for impregnation shall be in accordance with $\left\{\begin{array}{l}\text{Requisites for Impregnating Compound Treatment of Electrical Windings.}\\ \text{..}\end{array}\right\}$ Enameling shall be in accordance with $\left\{\begin{array}{l}\text{Specification for Enameled Round Copper Magnet Wire.}\\ \text{..}\end{array}\right\}$

A.A.R. SIGNAL SECTION SPECIFICATION 138-39.

INTERLOCKING LEVER CIRCUIT CONTROLLER

Official Approval

July 1926, Sept. 1931, Dec. 1935, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing circuit controller for application to interlocking machine. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Purchaser's drawings referred to in this specification form an essential part hereof.

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for material, design and assembly meeting the requirements of this specification in its entirety.

4. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted for the provisions contained in this specification.

5. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

6. *Design.*

(a) Controller shall conform to the following drawings or references:

1. ....
2. ....

(b) Controller shall be designed for application in accordance with the following drawings or references:

1. ....
2. ....

(c) Controller not protected by the interlocking machine case shall be enclosed in a separate substantial metallic case for each controller, the door or covering of which shall be equipped with suitable fastening for application of Purchaser's padlock and when open shall provide access to all parts. *R-6-c.

---

* Alternate requisites section.

PRINTED IN U. S. A.

A.A.R. SIGNAL SECTION INSTRUCTIONS.

INSPECTING AND TESTING MECHANICAL LOCKING OF AN INTERLOCKING MACHINE

1939

Official Approval

July 1926, July 1939.

Inspection.

1. The various parts of the locking bed, locking bed supports and connections must be inspected to see that they are properly secured.

2. Driving pieces, dogs, stops and trunnions must be inspected to see that they are properly secured to the locking bars.

3. Locking bars in new locking must have full stroke as follows:

(a) Mechanical interlocking machine, S. & F. locking............1¾ inches.

(b) Mechanical interlocking machine, Style "A" locking............7/16 inch.

(c) Electro-mechanical interlocking machine, S. & F. locking.
   1. Lever with full stroke having S. & F. driver............1¾ inches.
   2. Lever normally center having rack driver............2⅝ inches.

(d) Electro-mechanical interlocking machine, S. & F. miniature locking............1 inch.

(e) Electro-mechanical interlocking machine, Style "A" miniature locking.
   1. Vertical locking............¼ inch.
   2. Horizontal locking............11/32 inch.

(f) Power interlocking machine, S. & F. miniature locking............1 inch.

(g) Power interlocking machine, Style "A" miniature locking.
   1. Vertical locking............¼ inch.
   2. Horizontal locking............11/32 inch.

(h) Table interlocking machines.
   1. Type "A"............1½ inches.
   2. Style "TC"............1 inch.

4. Splices in longitudinal locking bars must be inspected to see that they are straight and properly made.

5. Where new locking is to be placed in service or a change in locking is made, the locking must be compared with the dog chart to see that they agree.

PRINTED IN U. S. A.

Testing.

6. Locking must be tested before interlocking machine is placed in service, when a change in locking is made and at intervals as instructed, as outlined in Instructions 7, 8, 9 and 11.

7. When lever or latch which should be locked can be moved more than shown below, it shall be considered as having too much lost motion and lost motion must be removed.*

- (a) Mechanical machine.
    - 1. Latch operated locking. When lever latch block can be raised to within $\frac{3}{8}$ inch of top of quadrant.
    - 2. Lever operated locking. When lever latch block can be moved more than $\frac{3}{8}$ inch on top of quadrant.
- (b) Electro-mechanical machine.
    - 1. Lever moving in horizontal plane. When lever can be moved more than $\frac{3}{16}$ inch when in normal position or $\frac{7}{16}$ inch when in reversed position.
    - 2. Lever moving in an arc. When lever can be moved more than 5 degrees.
- (c) Power machine.
    - 1. Latch operated locking. When lever latch block can be raised to within $\frac{7}{32}$ inch of top of quadrant.
    - 2. Lever moving in horizontal plane. When lever can be moved more than $\frac{5}{16}$ inch when in normal position or $\frac{9}{16}$ inch when in reversed position.
    - 3. Lever moving in an arc. When lever can be moved more than 5 degrees.

8. On electro-mechanical interlocking machines, the locking between the electric and its mechanical levers must be tested to insure that mechanical levers cannot be operated except when properly released by the electric levers.

9. Latch shoes, rocker links and quadrants of S. & F. machines must be inspected and tested for lost motion that would permit locking to release if the foot is used on the rocker while lever is in midstroke position.

10. Where new locking is to be placed in service or a change in locking is made, a complete test must be made of the locking from the locking sheet by placing all levers normal, when practicable, then testing levers consecutively, commencing with lever with lowest number to see that each lever locks all other levers in the position required by the locking sheet.

---

* These requirements are for interlocking machines in service. For new machines there should be practically no lost motion in locking or connections.

Testing.—Continued.

11. Complete test of the locking from a signal layout or interlocking plan must be made as follows:

(a) Test locking between switch, derail and movable point frog levers.

(b) Test locking between facing point lock and switch, derail and movable point frog levers.

(c) Set up each route and endeavor to release latch or operate each signal lever that should be locked by that route; then raise latch on signal lever, or reverse signal lever, governing movements over route, endeavor to release latch or operate each lever that should be locked by the signal lever; then restore latch or lever to normal position and make similar test with lever or latch for the opposing signal.

(d) Where route or traffic levers are used, make test as outlined for signal levers in Instruction 11-c.

12. When new locking is to be placed in service or a change in locking is made, to insure that locking of a route does not interfere with parallel routes, the parallel routes must be set up and signal levers operated for movements in both directions on each route.

A.A.R. SIGNAL SECTION SPECIFICATION 140-39.

PRESERVATIVE TREATMENT OF CAPPING AND GROOVED TRUNKING**

Official Approval
July 1926, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing treatment of capping and grooved trunking by the use of preservative. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Ordering.*

(a) Orders and requisitions shall specify kind of preservative, method of treatment and quantity of preservative to be retained.

(b) Capping and trunking to be treated shall be ordered in accordance with Specification 57.

3. *General requirements.*

(a) Preservative shall be A.R.E.A. Grade 1, Creosote Oil. *R-3-a.

(b) Charge shall contain not less than 90 per cent, nor more than 110 per cent, of the quantity of preservative specified. The amount of preservative retained shall be calculated on the basis of preservative at 100 deg. F., from readings of working-tank gages or scales, or from weights before and after treatment of loaded trams on suitable track scales, checked as may be desired by the Purchaser's representative. Volume corrections shall be based on the American Wood Preservers' Association table of factors to be used for determining the volume of creosote at 100 deg. F. when the oil is at temperatures ranging from 60 to 225 deg. F.

(c) Treating plants shall be equipped with thermometers and gages necessary to indicate and record accurately the conditions at all stages of treatment and shall be provided with apparatus and chemicals necessary for making the analyses and tests required by the Purchaser. Equipment shall be maintained in condition satisfactory to the Purchaser and apparatus and chemicals kept in condition for use at all times.

---

*Section 14026. Alternate requisites.

**Joint specification prepared by the Construction & Maintenance and Signal Sections.

A.A.R. SIGNAL SECTION SPECIFICATION 137-39.

OIL LIGHTED LAMP

Official Approval

July 1926, July 1939.

1. *Purpose.*

(a) This specification is for the purpose of providing an oil lighted lamp having interchangeability of parts. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for the replacement of existing material when general renewal or replacement becomes desirable.

2. *Drawings.*

(a) Drawings of lamps and parts thereof shall form an essential part of this specification.

3. *General requirements.*

(a) Lamps shall have top draught ventilation.

(b) Lamp bails shall be made of No. 4 (0.2043) A.W.G. steel wire.

(c) Top of bail shall extend 4½ in. above top of dome with a 3½ in. radius.

(d) Insect screen shall be provided when specified.

4. *Tinning.*

(a) Method of tinning shall be as follows:

1. Sheet steel parts before assembling shall be dipped in solution of muriatic acid, redipped in solution of tinning flux, then immersed in a lead tin alloy, containing not less than 40 per cent nor more than 50 per cent pure lead.

(b) When lens' hoods and lamp bottom have been assembled on lamp body, the body shall then be dipped in molten tin.

5. *Japanning.*

(a) Finished lamp shall be cleaned with a suitable cleaner to remove all grease and then sprayed outside with Black Baking Japan. After spraying they shall be baked at an even temperature at a minimum of 250 deg. F. for a sufficient length of time to secure a hard, durable finish.

6. *Switch lamp discs.*

(a) Discs shall be provided when specified and enameled as follows:

1. Dip in pickling solution to remove all scale and surface rust, apply a ground coat and two finishing coats of vitreous enamel and bake at high temperature a sufficient length of time to secure a hard and durable finish.

PRINTED IN U. S. A.

34. ***Electric lighting circuits.***

(a) Circuits for electric lights shall conform to plan submitted by the Purchaser.

(b) The maximum allowable drop in potential on circuits to any lamp shall be 10 per cent.

(c) Alternating current at .... volts, ... cycles distribution and .... volts, ... watt lamps shall be used. *R-34-c.

(d) Where primary battery is used for lighting, voltage regulators shall be used. *R-34-d.

35. ***Wires and cables.***

(a) Wires and cables shall be in accordance with the following specifications (*R-35-a):

1. Specification for Steel Guy and Messenger Strand.
2. Bare Copper-Covered Steel Line Wire, Thirty Per Cent Conductivity—Specification 167.
3. Bare Hard-Drawn Copper Line Wire—Specification 169.
4. Mineral Matter Rubber Compound Insulated Wire—Specification 111.
5. Aerial Aluminum Cable Steel Reinforced—Specification 54.
6. Aerial Braided Cable—Specification 89.
7. Armored Submarine Cable—Specification 90.
8. Lead-Covered Cable—Specification 91.
9. Parkway Cable—Specification 145.
10. ....
11. ....

36. ***Size of wire.***

(a) Wire shall be of sufficient size to permit operation of switch and signal mechanisms in accordance with this specification.

(b) Single-conductor wires external to the control station or instrument housing shall be not smaller than No. 14 A.W.G. Single-conductor wires within the control station or instrument housing shall be not smaller than No. 16 A.W.G.

(c) Wires in cable external to the control station shall be not smaller than No. 16 A.W.G.

(d) Line wires shall be not smaller than No. 10 A.W.G. for hard-drawn copper or No. 12 A.W.G. for copper-covered steel.

---

*Section 141-34. Alternate requisites.

ASSOCIATION OF AMERICAN RAILROADS

OPERATIONS AND MAINTENANCE DEPARTMENT

ENGINEERING DIVISION

SIGNAL SECTION

Manual of Recommended Practice

DRAWINGS

COMPLETE TO 1939 ANNUAL MEETING

Published by the Association
30 Vesey St., New York, N. Y.

255—1939

PRINTED IN U. S. A.

DRAWINGS

NUMERICAL LIST

1939

Drawing No.	TITLE	Original		Latest Rev.	
1002	Pipe Adjusting Screws—details and assembly	Dec.	1908	Feb.	1914
1007	Forged Cranks—details	Dec.	1908	Nov.	1913
1008B	One-Way Horizontal Crank Stand—details	Dec.	1908	Mar.	1927
1010E	Crank and Jaw Pins	Dec.	1908	Mar.	1935
1011C	One-Way Horizontal Crank Stand Assembly	Dec.	1908	Mar.	1934
1013B	Pipe Compensator Cranks—details	Dec.	1908	Mar.	1927
1014C	One-Way Horizontal Pipe Compensator—details and assembly	Dec.	1908	Mar.	1934
1015A	One-Inch Signal Pipe and Coupling	Dec.	1908	Mar.	1922
1016B	Screw and Solid Jaws—details	Dec.	1908	Mar.	1934
1017B	Tang End—Lug and Compensator Link —details and assembly	Dec.	1908	Mar.	1934
1018	Solid Jaws with Tang Ends—assembly	Dec.	1908	Nov.	1913
1019B	Jaws—Tang End and Adjustable Link —details and assembly	Dec.	1908	Mar.	1934
1021	Guide Clamps for Vertical Connections on Signals—details	Mar.	1915	June	1917
1022B	Guide Supports and Caps for Vertical Connections on Signals—details	Mar.	1915	Mar.	1935
1023B	Guides for Vertical Connections on Signals—assembly	Mar.	1915	Mar.	1935
1035B	Signal Masts—details and assembly	Mar.	1910	Apr.	1938
1036B	Socket Base for Bridge Mast	Mar.	1910	Mar.	1935
1040B	Semaphore Spectacle—Design "A"	Oct.	1909	Sept.	1930
1041B	Semaphore Spectacle	Oct.	1909	Sept.	1924
1043D	One-Arm Mechanical Ground Signal	Dec.	1910	Apr.	1938
1044D	Two-Arm Mechanical Ground Signal	Dec.	1910	Apr.	1938
1046A	Hand Lantern	Mar.	1937	Apr.	1938
1047A	Welded Type Rail Head Bonds and Track Circuit Connectors	Apr.	1938		
1048A	Mechanically Applied Rail Head Type Bonds and Track Circuit Connectors	Apr.	1938		
1049A	Details and Assembly of Adjustable Lamp Bracket	Oct.	1910	Mar.	1914
1052	Ladder Foundation	June	1910	Dec.	1913
1053B	Round Jars and Cover—primary battery	Oct.	1912	Mar.	1926
1054A	Multiple Unit Terminal Block	Mar.	1939		

PRINTED IN U. S. A.

Drawing No.	TITLE	Original		Latest Rev.	
1055C	Switch-Rod Insulation	Oct.	1910	Mar.	1936
1056C	Terminal Blocks—details and assembly	Mar.	1912	Mar.	1934
1057C	Two-Way Horizontal Crank Stand Assembly with Three-Way Stand and Single Pin	Oct.	1912	Mar.	1935
1058B	Anchor Post	Mar.	1913	Apr.	1938
1059A	Clamp for Base of Ground Mast Signals—details and assembly	Oct.	1911	Dec.	1915
1060	Rocking Shaft Arms	Mar.	1912	Oct.	1912
1061C	Rocking Shaft Bearings	Mar.	1912	Apr.	1938
1062	Rocking Shaft Assembly and Details	Mar.	1912	Dec.	1912
1063	Low Rocking Shaft Bearing	Oct.	1912	Oct.	1913
1064	Torque Curves for Electric Semaphore Spectacles	Oct.	1912	Mar.	1923
1065B	Wood Signal Blades	Oct.	1911	Sept.	1930
1066B	Details and Assembly of Single Vertical Crank Stand	Oct.	1911	Mar.	1934
1067	Details of Multiple Vertical Crank Stands	Oct.	1911	Nov.	1913
1069A	Deflecting Bars—details	Oct.	1912	Oct.	1917
1070E	Binding Posts	June	1910	Mar.	1936
1072B	Assembly of Transverse Pipe Carriers	Oct.	1911	Mar.	1935
1073	Details of Transverse Pipe Carriers	Oct.	1911	Mar.	1916
1074B	One-Way Pipe Carriers	Mar.	1935	Apr.	1938
1075B	Transverse Strap Pipe Carrier—Double Roller Type	Mar.	1935	Apr.	1938
1080	Concrete Foundations for Pipe Carriers	June	1910	Feb.	1914
1081A	Concrete Foundations for Air Pipe Lines	Mar.	1935		
1082	Mechanical Semaphore Bearings—details	Oct.	1910	Mar.	1920
1083	"U" Bolt and Clamp—for signal masts	Oct.	1910	Feb.	1914
1084B	Pipe Carrier—assembly	June	1912	Mar.	1928
1085B	Pipe Carrier—details	June	1912	Mar.	1928
1086B	Channel Pins	Oct.	1910	Mar.	1937
1090	Filler Block—to Limit Travel of Signal Arms—details and assembly	Oct.	1911	Dec.	1913
1091	Filler Block—to Limit Travel of Signal Arms—details and assembly	Oct.	1911	Dec.	1913
1092	Filler Block—to Prevent Travel of Signal Arms—details and assembly	Oct.	1911	Dec.	1913
1093	Diagram of Spectacle Clearance	Oct.	1911	Dec.	1913
1094C	Pipe-Line Insulation—for one-inch pipe	Oct.	1911	Mar.	1934
1095C	Details and Assembly of Multiple Unit Bolt Lock	Oct.	1911	Mar.	1934
1097	Mechanical Dwarf Signals—assembly	Oct.	1911	Sept.	1914

Drawing No.	TITLE	Original		Latest Rev.	
1100B	Semaphore Lamp—One Lens	Dec.	1908	Sept.	1925
1101B	Oil Fount	June	1910	Mar.	1926
1103A	Concrete Foundation for Horizontal Crank Stands	Oct.	1909	Oct.	1913
1104	Foundation for Compensator	Oct.	1909	Mar.	1913
1107C	Foundation for Ground Mast Signals	Oct.	1909	Mar.	1939
1156	Trunking—to be used when wires are placed underground in petroleum asphaltum	Dec.	1911		
1175	Hydrometer—stationary lead type storage battery	May	1915	Sept.	1916
1176	Trunking—Grooved Type	May	1912	Mar.	1922
1177	Trunking—Built-Up Type	May	1912	Mar.	1922
1178B	Clamps for Base of Bridge Masts—details and assembly	Oct.	1912	Mar.	1935
1192A	Cable Post	Mar.	1934		
1193A	Suspension Base for 5-Inch Mast	Mar.	1936		
1194	Details and Assembly of Mechanical Semaphore Bearing	Oct.	1912	Mar.	1920
1195	Operating Connections for Mechanical Signals—details and assembly	Oct.	1912	Mar.	1917
1197	Two-Lever Wall Machine—details and assembly	Oct.	1912	Dec.	1915
1200	Tower Leadouts—foundation for rocking shafts	June	1912		
1201	Tower Leadouts — mounted rocking shafts	June	1912		
1202	Details of Tower Leadouts—channels and I-beams	June	1912		
1203	Tower Leadouts—foundation for cranks and deflecting bars	June	1912		
1204	Tower Leadouts—mounted cranks and deflecting bars	June	1912		
1205B	Details of Tower Leadouts—mountings for cranks or deflecting bars	June	1912	Sept.	1929
1206	Tower Leadouts—mounted deflecting bars and rocking shafts	June	1912		
1207	Tower Leadouts — mounted rocking shafts—low bearings	May	1914		
1217	Tower Leadouts—foundation for crank, deflecting bars and rocking shafts	Oct.	1912		
1225B	Stuffing Box—for one-inch pipe	Oct.	1912	Sept.	1924
1232	Mechanical Dwarf Signal Top and Base Bearings—details	Sept.	1914		
1233	Mechanical Dwarf Signal Spectacles and Lamp Bracket Support—details and assembly	Oct.	1912	Sept.	1914

PRINTED IN U. S. A.

Drawing No.	TITLE	Original		Latest Rev.	
1236C	Two-Way Single-Lamp Signal	Mar.	1914	Mar.	1936
1238A	Details and Assembly of Marker Lights	Mar.	1914		
1239	Mechanical Dwarf Signal Fittings—details	Oct.	1913	Sept.	1914
1245A	Short Pinnacles	Mar.	1935		
1250A	Socket Base for 5-Inch Mast	Mar.	1935		
1251A	Wide Sweep Cable Pinnacle	Mar.	1935		
1254A	Switch Circuit Controller Connections	Mar.	1935		
1255C	Switch Circuit Controller Lug	Mar.	1935	Apr.	1938
1256A	Switch Circuit Controller Rods	Mar.	1935		
1259B	Foundation for Ground Mast Bottom Mechanism Signals—for single or double case	May	1916	Mar.	1936
1266B	Concrete Battery Box—assemblies	Mar.	1936	Mar.	1939
1267B	Concrete Battery Box—details	Mar.	1936	Mar.	1939
1268B	Concrete Battery Box—details	Mar.	1936	Mar.	1939
1269B	Concrete Battery Box—details	Mar.	1936	Mar.	1939
1331	Method of Laying Single and Sewer Pipe Duct	Oct.	1913	Sept.	1914
1332	Duct Reducers, Mandrels, Duct Plugs and Dowel Pins	Oct.	1913	Sept.	1914
1333	Manhole Frame (10" high) and Cover	Oct.	1913	Oct.	1914
1334	Cable Hanger Sockets, Sewer Steps and Manhole Clevis	Oct.	1913	Sept.	1914
1335	Vitrified Clay Duct	Oct.	1913		
1336	Method of Laying Single and Multiple Duct	Oct.	1913		
1337	Concrete Manhole	Oct.	1913	Sept.	1914
1338	Brick Manhole	Oct.	1913	Sept.	1914
1339	Manhole Frame (4" high) and Cover	May	1914	Sept.	1914
1355	Crank Bearings and Clamps—for two-way single-lamp signal	Mar.	1916		
1356	Double Spectacle Bearing and Lamp Bracket — for two-way single-lamp signal	Mar.	1916		
1357B	Ladders for Two-Way Single-Lamp Signal	Mar.	1916	Sept.	1924
1360	Tang Ends with Screw Jaws	May	1915	Dec.	1915
1362B	Ladder Parts—details	Mar.	1918	Sept.	1925
1363	Ladder Handrails—details and assembly	Mar.	1918		
1364B	Ladder Platforms—details and assembly	Mar.	1918	Mar.	1934
1365B	Ladders for Ground Mast Signals—assembly	Mar.	1917	Mar.	1936
1366B	Ladders for Bridge Masts	Mar.	1918	Mar.	1935
1371B	Ladder Clamps and Stays—details and assembly	Mar.	1918	Mar.	1935
1373C	Gage-Plate Insulation—Butt Joint for 7-Inch Plate	July	1920	Mar.	1937
1375B	Thermometer—lead type storage battery	Oct.	1917	Mar.	1935

Drawing No.	TITLE	Original		Latest Rev.	
1376	Double Tang Ends—details and assembly	Mar.	1918		
1377B	Methods of Measuring Ground Resistance	Mar.	1917	May	1933
1380A	Gage-Plate Insulation—Butt Joint for 8-Inch and 9-Inch Plate	Mar.	1937		
1387	Adapter-Base for Ground Mast Bottom Mechanism Signals—for adapting a single mechanism case to a double case foundation or vice versa	May	1916	Sept.	1916
1390C	Switch Adjustment Details	May	1915	Mar.	1935
1391C	Switch Adjustment — Non-insulated — assembly	May	1915	Mar.	1937
1392C	Switch Adjustment—Insulated—assembly	Sept.	1916	Mar.	1937
1393B	Two-Way Separate Pin Horizontal Crank Stand—details and assembly	Sept.	1916	Mar	1927
1396A	Horizontal Adjustable Deflecting Stands —details and assembly	June	1917	Oct.	1917
1397	Two-Lever Wall Machine—details	Sept.	1915	Dec.	1915
1398A	Crank Bearings and Clamps for 6-in. Pipe—for two-way single-lamp signal	June	1918		
1399B	Low Target Stand—details and assembly	Mar.	1916	Mar.	1928
1403	Branch Connection to Line Wire—Double Cross-Arm Support	Sept.	1919	Mar.	1920
1404	Branch Connection to Line Wire—Single Cross-Arm Support	Mar.	1920		
1405	Weatherproof Insulated Iron Line Wire Joint	Mar.	1920		
1406B	Insulated Wire Joint	Mar.	1920	May	1933
1407	Weatherproof Copper Line Wire Sleeve Type Joint	Mar.	1920		
1408	Stranded Wire Joint	Mar.	1920		
1409	Cotters—size—drilling—location	Mar.	1919	Dec.	1919
1411	Branch Connection to Dead-Ended Line Wires—Double Cross-Arm Support	Mar.	1920		
1412A	Dwarf Signal—Mechanical Escapement Cranks and Blanking Shield	Dec.	1920	Mar.	1921
1414	Roundels for Signals	July	1920		
1418A	250 A. H. Primary Battery Jar	Mar.	1939		
1419B	Rectangular Jars and Cover—primary battery	Mar.	1920	Mar.	1936
1422A	Adjustable Resistance—for testing	June	1918		
1424B	Ground Rods and Ground Pipes	Mar.	1917	Mar.	1934
1425C	Plunger Switch Lock — rectangular plunger	June	1921	Mar.	1936
1426C	Plunger Switch Lock—details—rectangular plunger	June	1921	Mar.	1936
1427B	Gages for Sheet Metal and Wire	Dec.	1920	Mar.	1925

Drawing No.	TITLE	Original		Latest Rev.	
1428	Bonding of an Electric R. R. Crossing with Steam R. R.—one rail of electric R. R. insulated from crossing	July	1920		
1429	Bonding of an Electric R. R. Crossing with Steam R. R.—rails of electric R. R. not insulated	July	1920		
1430B	Semaphore Lamp—Two Lens	Dec.	1919	Sept.	1925
1440B	Switch Lamp—spherical type	Sept.	1919	Sept.	1925
1441	Switch Lamp Base-Socket	Mar.	1920		
1442B	Lens Hoods and Couplings for Switch and Semaphore Lamps	Mar.	1920	Sept.	1925
1443B	Oil Fount	Mar.	1920	Mar.	1926
1445C	Switch Lamp Disc	Dec.	1920	Mar.	1937
1446A	Electric Lamp Case for Semaphore Lighting	Mar.	1937		
1449B	Base for 4-Inch Mast	Dec.	1919	Mar.	1939
1454B	Gage-Plate Insulation—lap joint	Mar.	1921	Mar.	1925
1456	Torque Testing Apparatus	June	1921		
1457B	Operating and Overload Curve Chart	June	1921	Sept.	1928
1458C	Cast-Iron Washer for Three-Fourths Inch and Seven-Eighths Inch Bolts	Mar.	1921	Mar.	1935
1459	Staff Tip Adapter	Mar.	1919	Sept.	1919
1460B	Switch Lamp—cylindrical type	June	1919	Sept.	1925
1461B	Switch Lamp Base-Socket—for cylindrical type switch lamp	Sept.	1919	Sept.	1925
1470B	Train Marker Lamp	June	1919	Sept.	1925
1480B	Engine Signal Lamp	Sept.	1919	Sept.	1925
1496	Highway Crossing Gate and Slow Track Sign Lamp Hangers	Mar.	1920		
1497B	Highway Crossing Gate Lamp Fount and Lens Hoods	Mar.	1920	Mar.	1926
1498	Highway Crossing Gate Lamp Handle and Alignment Clamp	Mar.	1920		
1499B	Highway Crossing Gate Lamp (this lamp may be used to indicate "slow track" lenses or roundels of proper color being used)	June	1919	Sept.	1925
1500	Machine Leg for Interlocking Machine—Style "A" Locking	Dec.	1920	June	1921
1501	Latch Shoe Details for Interlocking Machine—Style "A" Locking	Dec.	1920	June	1921
1502	Latch Shoe Assembly for Interlocking Machine—Style "A" Locking	Dec.	1920	June	1921
1503	Rocker Guide for Interlocking Machine—Style "A" Locking	Dec.	1920	June	1921
1504B	Lever Number Plate for Mechanical Interlocking Machines	Mar.	1921	Sept.	1927

PRINTED IN U. S. A.

Drawing No.	TITLE	Original		Latest Rev.	
1534	Single Switch Assembly: Attachment—Operating and Front Rods	June	1922	Mar.	1923
1535	Double-Slip Switch and Movable Point Frog Assembly: Attachment—Operating and Front Rods	June	1922	Mar.	1923
1536	Instructions for Applying Compensation	Mar.	1922	June	1922
1537	Compensation Chart	Oct.	1909	Mar.	1922
1538	Crank Chart	Mar.	1922		
1544B	Incandescent Electric Lamps and Adapter	Mar.	1923	Mar.	1929
1545B	Mechanical Dwarf Signal—assembly	Mar.	1923	Sept.	1925
1548	Enameled Steel Signal Blades	Nov.	1923	Mar.	1924
1550A	Semaphore Spectacle—for two-way single-lamp signal	Sept.	1924		
1551	Take Siding Indicator—Dimensions and Lettering	May	1914		
1552B	Base for One-Way Wall Machine	Nov.	1923	Sept.	1925
1553	Disc for Wig-Wag Highway Crossing Signal	Nov.	1923	Mar.	1924
1556	Bonding Manganese Frogs	Mar.	1923	Mar.	1924
1557A	Numerals and Letters	Sept.	1924		
1558A	Brackets for Numerals and Letters	Sept.	1924		
1563B	Electric Lamp Case	Sept.	1924	Sept.	1928
1564B	Electric Lamp Case	Sept.	1924	Sept.	1928
1565A	Latch Shoe and Latch Rod Assembly—for S. & F. interlocking machine	Sept.	1925		
1566A	Latch Shoe and Latch Rod Details—for S. & F. interlocking machine	Sept.	1925		
1567A	Mechanical Dwarf Signal—details	Sept.	1925		
1568A	Mechanical Dwarf Signal—details	Sept.	1925		
1583B	Ladders for Ground Masts—assembly	Sept.	1925	Mar.	1935
1585B	Ladder Parts	Sept.	1925	Mar.	1935
1586A	Locking Bar Splice—S. & F. machine	Sept.	1925	Mar.	1926
1587A	Adjustable Lock Rod	Sept.	1925		
1592A	Lamp Details	Sept.	1925	Mar.	1926
1593A	Lamp Details	Sept.	1925	Mar.	1926
1594A	Lamp Details	Sept.	1925	Mar.	1926
1595A	Lamp Details	Sept.	1925	Mar.	1926
1596A	Lamp Details	Sept.	1925	Mar.	1929

Drawing No.	TITLE	Original		Latest Rev.	
1599A	Details of Locking for S. & F. Machine	Sept.	1926		
1600A	Details of Locking for S. & F. Machine	Sept.	1926	Mar.	1927
1611D	Hand Lantern Globes	Sept.	1926	Mar.	1939
1612A	Grade Signal Marker	Mar.	1934		
1613A	Spring Switch Marker	Mar.	1934		
1614A	Base for Ground Signal Masts	Sept.	1927		
1615A	Foundation for Mechanical Dwarf Signals	Sept.	1927	Mar.	1928
1616A	Light Signal Masts	Sept.	1928	Mar.	1929
1617A	Light Signal Masts	Sept.	1928	Mar.	1929
1618A	Light Signal Masts	Sept.	1928	Mar.	1929
1619A	Ladders and Platform Parts for Light Signal Masts—details and assembly	Sept.	1928		
1620A	Ladders for Light Signal Masts—assembly	Sept.	1928		
1621A	Application of Light Signal Units to Masts	Mar.	1929		
1622A	Tags for Marking Wires	Sept.	1929	Mar.	1930
1623A	Pattern and Mold for Arbitration Test Bar	Mar.	1930		
1624A	Tension Test Specimen	Mar.	1930		
1626B	Instrument Case—Style "A"	Sept.	1930	Apr.	1938
1627B	Instrument Case—Style "B"	Sept.	1930	Apr.	1938
1628B	Instrument Case—Style "C"	Sept.	1930	Apr.	1938
1629A	Base for Instrument Case—Style "A"	Sept.	1930		
1630A	Base for Instrument Cases—Styles "B" and "C"	Sept.	1930		
1631C	Single Conductor Plug Type Rail Bonds and Track Circuit Connectors	Sept.	1930	Apr.	1938
1632C	Duplex Conductor Plug Type Rail Bonds and Track Circuit Connectors	Sept.	1930	Apr.	1938
1633B	Relay Contact Post Designation Plate	Sept.	1930	Mar.	1936
1634B	Insulated Joint Location—Automatic Signals and Interlocking	Mar.	1934	Mar.	1937
1635B	Insulated Joint Location—Non-Interlocked Switches	Mar.	1934	Mar.	1937
1636B	Insulated Joint Location—Railroad Crossings—Highway Crossings	Mar.	1934	Mar.	1937
1637B	Insulated Joint Location—Electric Operation Territory	Mar.	1934	Mar.	1937
1638A	Insulated Joint Location—Slip Switches and Frogs, Single or Double Rail Circuits	Mar.	1934		
1639A	Insulated Joint Location—Car Retarder Layout	Mar.	1934		
1640B	90° Cast-Iron Crossing Sign	May	1933	Mar.	1937
1641B	Adapter Clamp for Crossing Signs	May	1933	Mar.	1937

Drawing No.	TITLE	Original	Latest Rev.
1642B	90° Reflector Crossing Sign Assemblies	May 1933	Mar. 1937
1643B	90° Reflector Crossing Sign Details	May 1933	Mar. 1937
1644B	Cast-Iron Multiple Track Sign	May 1933	Mar. 1937
1645B	Reflector Multiple Track Sign	May 1933	Mar. 1937
1646B	Reflector Stop on Red Signal Sign	May 1933	Mar. 1937
1647C	Adapter Clamp and Details for Signs	May 1933	Mar. 1937
1648B	Reflector Stop When Swinging Sign	May 1933	Mar. 1937
1649A	Reflector Crossing Signal Marker	May 1933	
1650B	Details of Numerals for Track Signs	May 1933	Mar. 1937
1651B	Highway Crossing Signal Assembly—Wig-Wag Type	Mar. 1934	Mar. 1937
1652B	Highway Crossing Signal Assembly—Wig-Wag Type	Mar. 1934	Mar. 1937
1653B	Highway Crossing Signal Assembly—Flashing Light Type	Mar. 1934	Mar. 1937
1654B	Highway Crossing Signal Assembly—Flashing Light Type	Mar. 1934	Mar. 1937
1655B	Bolts for Crossing Signs for 4″ or 5″ Pipe	Mar. 1935	Mar. 1937
1656B	Junction Box and Cross-Arm for Flashing Light Highway Crossing Signals	Mar. 1936	
1657B	Junction Box and Cross-Arm Details for Flashing Light Highway Crossing Signals	Mar. 1936	
1660A	Graphical Symbols—Wayside Signal Operating Characteristics	Mar. 1934	
1661A	Graphical Symbols—Signal Supports	Mar. 1934	
1662A	Graphical Symbols—Tracks and Highway Crossings	Mar. 1934	
1663A	Graphical Symbols—Buildings, Bridges and Tunnels	Mar. 1934	
1664A	Graphical Symbols—Wayside Fixtures	Mar. 1934	
1665A	Graphical Symbols—Switches	Mar. 1934	
1666A	Graphical Symbols—Derails	Mar. 1934	
1667A	Graphical Symbols—Track Appliances	Mar. 1934	
1668A	Graphical Symbols—Leadouts, Bolt Locks and Stands	Mar. 1934	
1669A	Graphical Symbols—Pipe and Wire Lines	Mar. 1934	
1673A	Graphical Symbols—Relays	Mar. 1934	
1674A	Graphical Symbols—Relay Contacts	Mar. 1934	
1675A	Graphical Symbols—Circuit Controller Contacts—Miscellaneous	Mar. 1934	
1676A	Graphical Symbols—Circuit Controller Contacts—Contacts Actuated Mechanically by Interlocking Machine Lever	Mar. 1934	
1677A	Graphical Symbols—Switch Movement and Contacts—Contacts Actuated by Switch Points, Derails or Locking Connections	Mar. 1934	

Drawing No.	TITLE	Original	Latest Rev.
1678A	Graphical Symbols—Signal Mechanism and Contacts—Contacts Actuated by Signal Arms or Mechanisms	Mar. 1934	
1679A	Graphical Symbols—Indicators and Locks	Mar. 1934	
1680A	Graphical Symbols—Circuit Appurtenances	Mar. 1934	
1681A	Graphical Symbols—Miscellaneous Apparatus	Mar. 1934	
1686A	Highway Crossing Flashing Light Signal Assembly—Cantilever Type	Mar. 1937	
1691A	Highway Crossing Sign—50° Reflector Type	Mar. 1939	
1692A	50° Reflector Crossing Sign Assembly	Mar. 1939	
1693A	50° Reflector Crossing Sign Details	Mar. 1939	
1694A	Precast Foundation for 4-Inch Mast—Details and Assemblies	Mar. 1939	
1695A	Precast Foundation for 4-Inch Mast—Details	Mar. 1939	

DRAWINGS

INDEX—ALPHABETICAL

1939

Title	Drawing No.
Adapter	
Base for Ground Mast Bottom Mechanism Signals	1387
Clamp and Details for Signs	1647C
Clamp for Crossing Signs	1641B
Incandescent Electric Lamps and	1544B
Staff Tip	1459
Adjustable	
Deflecting Stands; Horizontal—details and assembly	1396A
Lamp Bracket, Details and Assembly of	1049A
Link; Jaws—Tang End and—details and assembly	1019B
Lock Rod	1587A
Resistance—for testing	1422A
Adjusting Screws, Pipe—details and assembly	1002
Adjustment, Switch	
Details	1390C
Insulated—assembly	1392C
Non-Insulated—assembly	1391C
Air Pipe Lines, Concrete Foundations for	1081A
Alignment Clamp, Highway Crossing Gate Lamp Handle and	1498
Anchor Post	1058B
Apparatus, Miscellaneous—Graphical Symbols	1681A
Apparatus, Torque Testing	1456
Appliances, Track—Graphical Symbols	1667A
Application of Light Signal Units to Masts	1621A
Applying Compensation, Instructions for	1536
Appurtenances, Circuit—Graphical Symbols	1680A
Arbitration Test Bar, Pattern and Mold for	1623A
Arms	
Cross, Pole Line Hardware, etc.—See Part 51, Specification Section.	
Cross, Support	
Double; Branch Connection to Dead-Ended Line Wires	1411
Double; Branch Connection to Line Wire	1403
Single; Branch Connection to Line Wire	1404
Rocking Shaft	1060
Asphaltum, Petroleum; When Wires are Placed Underground in, Trunking to be Used	1156

Title	Drawing No.
Assembly (See also Details and Assembly)	
Concrete Battery Box	1266B
Double-Slip Switch and Movable Point Frog: Attachment—Operating and Front Rods	1535
Fifty Degree Reflector Crossing Sign	1692A
Guides for Vertical Connections on Signals	1023B
Highway Crossing Flashing Light Signal—Cantilever Type	1686A
Highway Crossing Signal	
Flashing Light Type	1653B, 1654B
Wig-Wag Type	1651B, 1652B
Ladders for	
Bracket Mast Signals	1366
Ground Mast Signals	1365B
Ground Masts	1583B
Light Signal Masts	1620A
Latch Shoe and Latch Rod—for S. & F. Interlocking Machine	1565A
Latch Shoe for Interlocking Machine—Style "A" Locking	1502
Mechanical Dwarf Signals	1097, 1545B
Ninety-Degree Reflector Crossing Sign	1642B
One-Way Horizontal Crank Stand	1011C
Pipe Carrier	1084B
Single Switch: Attachment—Operating and Front Rods	1534
Solid Jaws with Tang Ends	1018
Switch Adjustment	
Insulated	1392C
Non-Insulated	1391C
Transverse Pipe Carriers	1072B
Two-Way Horizontal Crank Stand, with Three-Way Stand and Single Pin	1057C
Assembly and Details (See Details and Assembly.)	
Attachment—Operating and Front Rods	
Double-Slip Switch and Movable Point Frog Assembly	1535
Single Switch Assembly	1534
Automatic Signals and Interlocking—Insulated Joint Location	1634B
Bar, Arbitration Test; Pattern and Mold for	1623A
Bar Splice, Locking—S. & F. Machine	1586A
Bars	
Deflecting	
Details	1069A
Foundation for Cranks and; for Tower Leadouts	1203
Foundation for Cranks; Rocking Shafts and; for Tower Leadouts	1217
Mounted, and Rocking Shafts; for Tower Leadouts	1206
Mounted Cranks and; for Tower Leadouts	1204
Mountings for Cranks or, Details of; for Tower Leadouts	1205B
Base	
Adapter; for Ground Mast Bottom Mechanism Signals	1387
Bearings, Top and; Mechanical Dwarf Signal—details	1232

Title	Drawing No.
Base—Continued	
For	
Four-Inch Mast	1449B
Precast Foundation for—details and assembly	1694A, 1695A
Ground Mast Bottom Mechanism Signals; Adapter	1387
Ground Signal Masts	1614A
Instrument Cases	
Style "A"	1629A
Styles "B" and "C"	1630A
One-Way Wall Machine	1552B
Of	
Bridge Masts, Clamps for—details and assembly	1178B
Ground Mast Signal, Clamp for—details and assembly	1059A
Socket, for	
Bridge Mast	1036B
Five-Inch Mast	1250A
Socket, Switch Lamp	
For cylindrical type switch lamp	1461B
For spherical type switch lamp	1441
Suspension, for 5-Inch Mast	1193A
Battery	
Box, Concrete	
Assemblies	1266B
Details	1267B, 1268B, 1269B
Primary	
Rectangular Jars and Cover	1418A, 1419B
Round Jars and Cover	1053B
Storage	
Hydrometer—stationary lead type	1175
Thermometer—lead type	1375B
Beams, "I"; Channels and, for Tower Leadouts; Details of	1202
Bearing	
Crank, and Clamps for	
Six-Inch Pipe—for two-way single-lamp signal	1398A
Two-Way Single-Lamp Signal	1355
Double Spectacle, and Lamp Bracket—for two-way single-lamp signal	1356
Low; Mounted Rocking Shafts for Tower Leadouts	1207
Low Rocking Shaft	1063
Rocking Shaft	1061C
Semaphore, Mechanical	
Details	1082
Details and Assembly	1194
Top and Base; Mechanical Dwarf Signal—details	1232
Binding Posts	1070E
Blades, Signal	
Enameled Steel	1548
Wood	1065B
Blanking Shield, Mechanical Escapement Cranks and; Dwarf Signal	1412A
Block	
Filler	
To Limit Travel of Signal Arms—details and assembly	1090, 1091
To Prevent Travel of Signal Arms—details and assembly	1092
Terminal—details and assembly	1056C
Terminal, Multiple Unit	1054A

Title	Drawing No.
Bolts	
For Crossing Signs, for 4″ or 5″ Pipe	1655B
Lock, Multiple-Unit; Details and Assembly of	1095C
Locks, Leadouts, and Stands—Graphical Symbols	1668A
Three-Fourths Inch and Seven-Eighths Inch; Cast-Iron Washer for	1458C
"U", and Clamp for Signal Masts	1083
Bonding	
Manganese Frogs	1556
Of an Electric Railroad Crossing with Steam Railroad	
One Rail of Electric Railroad Insulated from Crossing	1428
Rails of Electric Railroad Not Insulated	1429
Bonds, Rail Head, and Track Circuit Connectors	
Mechanically Applied Type	1048A
Welded Type	1047A
Bonds, Rail, Plug Type, and Track Circuit Connectors	
Duplex Conductor	1632C
Single Conductor	1631C
Bottom Mechanism Signals	
Adapter-Base for Ground Mast	1387
Foundation for Ground Mast	1259B
Box	
Concrete Battery	
Assemblies	1266B
Details	1267B, 1268B, 1269B
Junction and Cross-Arm for Flashing Light Highway Crossing Signals	1656B
Details	1657B
Stuffing, for One-Inch Pipe	1225B
Bracket	
Adjustable Lamp; Details and Assembly of	1049A
For Numerals and Letters	1558A
Lamp; Double Spectacle Bearing and—for two-way single-lamp signal	1356
Support, Lamp; Mechanical Dwarf Signal Spectacles and—details and assembly	1233
Branch Connection to Line Wires	
Dead-Ended, Double Cross-Arm Support	1411
Double Cross-Arm Support	1403
Single Cross-Arm Support	1404
Brick Manhole	1338
Bridge Masts	
Clamps for Base of—details and assembly	1178B
Ladders for	1366B
Socket Base for	1036B
Bridges, Buildings and Tunnels—Graphical Symbols	1663A
Buildings, Bridges and Tunnels—Graphical Symbols	1663A
Built-Up Type Trunking	1177
Butt Joint—Gage-Plate Insulation	
For 7″ Plate	1373C
For 8″ and 9″ Plate	1380A
Cable	
Hanger Sockets, Sewer Steps and Manhole Clevis	1334
Pinnacle, Wide Sweep	1251A
Post	1192A
Cantilever Type Highway Crossing Flashing Light Signal Assembly	1686A
Caps for Vertical Supports on Signals, Guide Supports and—details	1022B

Title	Drawing No.
Car Retarder Layout—Insulated Joint Location	1639A
Carrier, Pipe	
Assembly	1084B
Concrete Foundations for	1080
Details	1085B
One-Way	1074B
Transverse	
Assembly	1072B
Details	1073
Strap, Double Roller Type	1075B
Case	
Instrument	
Base for	
Style "A"	1629A
Styles "B" and "C"	1630A
Style "A"	1626B
Style "B"	1627B
Style "C"	1628B
Lamp; Electric (Semaphore Signals)	1563B, 1564B
For Semaphore Lighting	1446A
Cast-Iron Crossing Sign, 90 Deg.	1640B
Cast-Iron Multiple Track Sign	1644B
Cast-Iron Washer for Three-Fourths Inch and Seven-Eighths Inch Bolts	1458C
Channel	
And I-Beams for Tower Leadouts; Details of	1202
Pins	1086B
Characteristics, Wayside Signal Operating—Graphical Symbols	1660A
Chart	
Compensation	1537
Crank	1538
Curve; Operating and Overload	1457B
Circuit Appurtenances—Graphical Symbols	1680A
Circuit Connectors, Track; Plug Type Rail Bonds and	
Duplex Conductor	1632C
Single Conductor	1631C
Circuit Connectors, Track; Rail Head Bonds and	
Mechanically Applied Type	1048A
Welded Type	1047A
Circuit Controller Contacts—Graphical Symbols	
Contacts Actuated Mechanically by Interlocking Machine Lever	1676A
Miscellaneous	1675A
Circuit Controller, Switch	
Connections	1254A
Lug	1255C
Rods	1256A
Circuits, Single or Double Rail, Slip Switches and Frogs—Insulated Joint Location	1638A
Clamps	
Adapter	
And Details for Signs	1647C
For Crossing Signs	1641B
Alignment; Highway Crossing Gate Lamp and	1498
For	
Base of Bridge Masts—details and assembly	1178B
Base of Ground Mast Signals—details and assembly	1059A
Signal Masts; "U" Bolt and	1083

Title	Drawing No.
Clamps—Continued	
For—Continued	
Six-Inch Pipe; Crank Bearings and—for two-way single-lamp signal	1398A
Two-Way Single-Lamp Signal; Crank Bearings and	1355
Guide, For Vertical Connections on Signals—details	1021
Ladder, and Stays—details and assembly	1371B
Clay Duct; Vitrified	1335
Clearance Spectacle; Diagram of	1093
Clevis, Manhole; Cable Hanger Sockets, Sewer Steps and	1334
Compensation	
Chart	1537
Instructions for Applying	1536
Compensator	
Cranks; Pipe—details	1013B
Foundation for	1104
Link; Tang End—Lug and—details and assembly	1017B
Pipe, One-Way Horizontal—details and assembly	1014C
Concrete	
Battery Box	
Assemblies	1266B
Details	1267B, 1268B, 1269B
Foundations for	
Air Pipe Lines	1081A
Horizontal Crank Stands	1103A
Pipe Carriers	1080
Manhole	1337
Connection	
Branch, to Line Wire	
Dead-Ended, Double Cross-Arm Support	1411
Double Cross-Arm Support	1403
Single Cross-Arm Support	1404
On Signals, Vertical	
Guide Clamps for—details	1021
Guide Supports and Caps for—details	1022B
Guides for—assembly	1023B
Operating, for Mechanical Signals—details and assembly	1195
Switch Circuit Controller	1254A
Connectors, Track Circuit; Plug Type Rail Bonds and	
Duplex Conductor	1632C
Single Conductor	1631C
Connectors, Track Circuit; Rail Head Bonds and	
Mechanically Applied Type	1048A
Welded Type	1047A
Contact Post Designation Plate, Relay	1633B
Contacts, Circuit Controller—Graphical Symbols	
Contacts Actuated Mechanically by Interlocking Machine Lever	1676A
Miscellaneous	1675A
Contacts, Relay—Graphical Symbols	1674A
Contacts, Signal Mechanism and—Contacts Actuated by Signal Arms or Mechanisms—Graphical Symbols	1678A
Contacts, Switch Movement and—Contacts Actuated by Switch Points, Derails or Locking Connections	1677A

Title	Drawing No.
Controller Contacts, Circuit—Graphical Symbols	
Contacts Actuated Mechanically by Interlocking Machine Lever	1676A
Miscellaneous	1675A
Controller, Switch Circuit	
Connections	1254A
Lug	1255C
Rods	1256A
Copper Line Wire; Weatherproof, Sleeve Type Joint	1407
Cotters—size—drilling—location	1409
Coupling	
For Switch and Semaphore Lamps; Lens Hoods and	1442B
One-Inch Signal Pipe and	1015A
Covers	
Manhole Frame and	
4 in. High	1339
10 in. High	1333
Rectangular Jars and—primary battery	1418A, 1419B
Round Jars and—primary battery	1053B
Crank	
And Jaw Pins	1010E
Bearings and Clamps for	
Six-Inch Pipe—for two-way single-lamp signal	1398A
Two-Way Single-Lamp Signal	1355
Chart	1538
Deflecting Bars and Rocking Shafts for Tower Leadouts; Foundation for	1217
Escapement, Mechanical, and Blanking Shield—Dwarf Signal	1412A
Forged—details	1007
Foundation for, and Deflecting Bars for Tower Leadouts	1203
Horizontal, Stands; Concrete Foundation for	1103A
Mounted, and Deflecting Bars for Tower Leadouts	1204
Mountings for, or Deflecting Bars, for Tower Leadouts; Details of	1205B
Pipe Compensator—details	1013B
Stands	
Horizontal	
Assembly, Two-Way, with Three-Way Stand and Single Pin	1057C
Concrete Foundation for	1103A
One-Way Assembly	1011C
One-Way—details	1008B
Two-Way Separate Pin—details and assembly	1393B
Vertical	
Multiple; Details of	1067
Single; Details and Assembly of	1066B
Cross-Arm, Junction Box and, for Flashing Light Highway Crossing Signals	1656B
Details	1657B
Cross-Arm Support	
Double; Branch Connection to Dead-Ended Line Wires	1411
Double; Branch Connection to Line Wire	1403
Single; Branch Connection to Line Wire	1404
Cross-Arms, Pole Line Hardware, etc.—See Part 51, Specification Section.	
Crossing	
Electric Railroad with Steam Railroad; Bonding of	
One Rail of Electric Railroad Insulated from Crossing	1428
Rails of Electric Railroad Not Insulated	1429

Title	Drawing No.
Crossing—Continued	
Gate, Highway	
And Slow Track Sign Lamp Hangers	1496
Lamp	1499B
Fount and Lens Hoods	1497B
Handle and Alignment Clamp	1498
Highway, Flashing Light Signal Assembly—Cantilever Type	1686A
Highway—Railroad—Insulated Joint Location	1636B
Highway, Tracks and—Graphical Symbols	1662A
Railroad—Highway—Insulated Joint Location	1636B
Sign, Highway; 50 Degree Reflector Type	1691A
Assembly	1692A
Details	1693A
Sign, 90 Degree	
Cast-Iron	1640B
Reflector	
Assemblies	1642B
Details	1643B
Signal, Highway, Assembly	
Flashing Light Type	1653B, 1654B
Wig-Wag Type	1651B, 1652B
Signal, Highway, Wig-Wag; Disc for	1553
Signal Marker, Reflector	1649A
Signals, Highway, Flashing Light; Junction Box and Cross-Arm for	1656B
Details	1657B
Signs, Adapter Clamp for	1641B
Signs, Bolts for, for 4″ or 5″ Pipe	1655B
Curve Chart, Operating and Overload	1457B
Curves, Torque; for Electric Semaphore Spectacles	1064
Cylindrical Type Switch Lamp	1460B
Base—Socket for	1461B
Dead-Ended Line Wires, Double Cross-Arm Supports; Branch Connection to	1411
Deflecting Bars	
And Rocking Shafts, Foundation for Crank; for Tower Leadouts	1217
Details	1069A
For Tower Leadouts	
Foundation for Cranks and	1203
Mounted, and Rocking Shafts	1206
Mounted Cranks and	1204
Mountings for Cranks or	1205B
Deflecting Stands, Horizontal Adjustable—details and assembly	1396A
Derails—Graphical Symbols	1666A
Design "A" Semaphore Spectacle	1040B
Designation Plate, Relay Contact Post	1633B
Details (See also Details and Assembly)	
Adapter Clamp and, for Signs	1647C
Concrete Battery Box	1267B, 1268B, 1269B
Deflecting Bars	1069A
Forged Cranks	1007
Guide	
Clamps for Vertical Connections on Signals	1021
Supports and Caps for Vertical Connections on Signals	1022B
Junction Box and Cross-Arm, for Flashing Light Highway Crossing Signals	1657B
Ladder Parts	1362B
Lamp	1592A, 1593A, 1594A, 1595A, 1596A
Latch Shoe and Latch Rod—for S. & F. Interlocking Machine	1566A
Latch Shoe for Interlocking Machine—Style "A" Locking	1501
Locking for S. & F. Machine	1599A, 1600A

Title	Drawing No.
Details (See also Details and Assembly)—Continued	
Mechanical Dwarf Signal	1567A, 1568A
Fittings	1239
Top Base Bearings	1232
Mechanical Semaphore Bearing	1082
Multiple Vertical Crank Stands	1067
Numerals for Track Signs	1650B
One-Way Horizontal Crank Stand	1008B
Pipe Carrier	1085B
Pipe Compensator Cranks	1013B
Plunger Switch Lock—rectangular plunger	1426C
Precast Foundation for 4-Inch Mast	1695A
Reflector Crossing Sign	
50 Degree	1693A
90 Degree	1643B
Screw and Solid Jaws	1016B
Switch Adjustment	1390C
Tower Leadouts	
Channels and I-Beams	1202
Mountings for Cranks or Deflecting Bars	1205B
Transverse Pipe Carriers	1073
Two-Lever Wall Machine	1397
Details and Assembly (See also Details)	
Adjustable Lamp Bracket	1049A
Clamp for Base of Ground Mast Signals	1059A
Clamps for Base of Bridge Masts	1178B
Double Tang Ends	1376
Filler Block	
To Limit Travel of Signal Arms	1090, 1091
To Prevent Travel of Signal Arms	1092
Horizontal Adjustable Deflecting Stands	1396A
Jaws—Tang End and Adjustable Link	1019B
Ladder	
Clamps and Stays	1371B
Handrails	1363
Platforms	1364B
Ladders and Platform Parts for Light Signal Masts	1619A
Low Target Stand	1399B
Marker Lights	1238A
Mechanical Dwarf Signal Spectacles and Lamp Bracket Support	1233
Mechanical Semaphore Bearing	1194
Multiple-Unit Bolt Lock	1095C
One-Way Horizontal Pipe Compensator	1014C
Operating Connections for Mechanical Signals	1195
Pipe Adjusting Screws	1002
Precast Foundation for 4-Inch Mast	1694A
Rocking Shaft	1062
Signal Masts	1035B
Single Vertical Crank Stand	1066B
Tang End—Lug and Compensator Link	1017B
Terminal Blocks	1056C
Two-Lever Wall Machine	1197, 1397
Two-Way Separate Pin Horizontal Crank Stand	1393B

Title	Drawing No.
Diagram of Spectacle Clearance	1093
Dimensions and Lettering—Take Siding Indicator	1551
Disc	
For Wig-Wag Highway Crossing Signal	1553
Switch Lamp	1445C
Double	
Cross-Arm Support	
Branch Connection to Dead-Ended Line Wires	1411
Branch Connection to Line Wire	1403
Rail Circuits, or Single, Slip Switches and Frogs—Insulated Joint Location	1638A
Slip Switch and Movable Point Frog Assembly: Attachment—Operating and Front Rods	1535
Spectacle Bearing and Lamp Bracket—for two-way single-lamp signal	1356
Tang Ends—details and assembly	1376
Dowel Pins; Duct Reducers, Mandrels, Duct Plugs and	1332
Duct	
Method of Laying Single and Multiple	1336
Plugs and Dowel Pins; Duct Reducers, Mandrels	1332
Reducers, Mandrels, Duct Plugs and Dowel Pins	1332
Single and Sewer Pipe; Method of Laying	1331
Vitrified Clay	1335
Duplex Conductor Plug Type Rail Bonds and Track Circuit Connectors	1632C
Dwarf Signal	
Mechanical	
Assembly	1097, 1545B
Details	1567A, 1568A
Escapement Cranks and Blanking Shield	1412A
Fittings—details	1239
Foundation for	1615A
Spectacles and Lamp Bracket Supports—details and assembly	1233
Top and Base Bearings—details	1232
Electric	
Incandescent Lamps and Adapter	1544B
Lamp Case (Semaphore Signals)	1563B, 1564B
For Semaphore Lighting	1446A
Motor Switch Operating Mechanism; Operating and Overload Curve Chart	1457B
Operation Territory—Insulated Joint Location	1637B
Railroad Crossing with Steam Railroad; Bonding of	
One Rail of Electric Railroad Insulated from Crossing	1428
Rails of Electric Railroad Not Insulated	1429
Semaphore Spectacles; Torque Curves for	1064
Enameled Steel Signal Blades	1548
End, Tang	
And Adjustable Link; Jaws—details and assembly	1019B
Double—details and assembly	1376
Lug and Compensator Link—details and assembly	1017B

Title	Drawing No.
End, Tang—Continued	
Solid Jaws with—assembly	1018
With Screw Jaw	1360
Engine Signal Lamp	1480B
Escapement Cranks, Mechanical, and Blanking Shield; Dwarf Signal	1412A
Fifty Degree Reflector Type Highway Crossing Sign	1691A
Assembly	1692A
Details	1693A
Filler Block	
To Limit Travel of Signal Arms—details and assembly	1090, 1091
To Prevent Travel of Signal Arms—details and assembly	1092
Fittings for Mechanical Dwarf Signal—details	1239
Five-Inch Mast, Socket Base for	1250A
Five-Inch Mast, Suspension Base for	1193A
Five-Inch Pipe, Bolts for Crossing Signs for	1655A
Fixtures, Wayside—Graphical Symbols	1664A
Flashing Light Highway Crossing Signals, Junction Box and Cross-Arm for	1656B
Details	1657B
Flashing Light Signal Assembly, Highway Crossing—Cantilever Type	1686A
Flashing Light Type Highway Crossing Signal Assembly	1653B, 1654B
Forged Cranks—details	1007
Foundation for	
Air Pipe Line, Concrete	1081A
Compensator	1104
Crank, Deflecting Bars and Rocking Shafts for Tower Leadouts	1217
Cranks and Deflecting Bars for Tower Leadouts	1203
Flashing Light Signal	1107C, 1694A, 1695A
Four-Inch Mast, Precast—details and assemblies	1694A, 1695A
Ground Mast Bottom Mechanism Signals	1259B
Ground Mast Signals	1107C
Horizontal Crank Stands; Concrete	1103A
Ladder	1052
Mechanical Dwarf Signals	1615A
Pipe Carriers; Concrete	1080
Rocking Shaft for Tower Leadouts	1200
Wig-Wag Signal	1107C, 1694A, 1695A
Fount	
Lamp, and Lens Hoods; Highway Crossing Gate	1497B
Oil	
For Semaphore Lamp	1101B
For Spherical Type Lamp	1443B
Four-Inch Mast	
Base for	1449B
Precast Foundation for—details and assemblies	1694A, 1695A
Frame, Manhole, and Cover	
4 in. High	1339
10 in. High	1333
Frog, Movable Point Double-Slip Switch Assembly: Attachment—Operating and Front Rods	1535
Frogs, Manganese; Bonding	1556
Frogs, Slip Switches and, Single or Double Rail Circuits—Insulated Joint Location	1638A
Front Rods, Attachment—Operating and	
Double-Slip Switch and Movable Point Frog Assembly	1535
Single Switch Assembly	1534

Title	Drawing No.
Gage-Plate Insulation—Butt Joint	
For 7″ Plate	1373C
For 8″ and 9″ Plate	1380A
Gage-Plate Insulation—Lap Joint	1454B
Gages for Sheet Metal and Wire	1427B
Gate, Highway Crossing	
And Slow Track Sign Lamp Hangers	1496
Lamp	1499B
Fount and Lens Hoods	1497B
Handle and Alignment Clamp	1498
Globes, Hand Lantern	1611D
Grade Signal Marker	1612A
Graphical Symbols	
Buildings, Bridges and Tunnels	1663A
Circuit Appurtenances	1680A
Circuit Controller Contacts	
Contacts Actuated Mechanically by Interlocking Machine Lever	1676A
Miscellaneous	1675A
Derails	1666A
Indicators and Locks	1679A
Lead-Outs, Bolt Locks and Stands	1668A
Miscellaneous Apparatus	1681A
Pipe and Wire Lines	1669A
Relay Contacts	1674A
Relays	1673A
Signal Mechanism and Contacts—Contacts Actuated by Signal Arms or Mechanisms	1678A
Signal Supports	1661A
Switch Movement and Contacts—Contacts Actuated by Switch Points, Derails or Locking Connections	1677A
Switches	1665A
Track Appliances	1667A
Tracks and Highway Crossings	1662A
Wayside Fixtures	1664A
Wayside Signal Operating Characteristics	1660A
Grooved Type Trunking	1176
Ground	
Mast Signals	
Bottom Mechanism	
Adapter-Base for	1387
Foundation for	1259B
Clamp for Base of—details and assembly	1059A
Foundation for	1107C
Ladders for—assembly	1365B
Masts, Ladders for—assembly	1583B
Pipes, Ground Rods and	1424B
Resistance, Methods of Measuring	1377B
Rods and Ground Pipes	1424B
Signal	
Masts, Base for	1614A
Mechanical	
One-Arm	1043D
Two-Arm	1044D

Title	Drawing No.
Guide	
Clamps for Vertical Connections on Signals—details	1021
For Vertical Connections on Signals—assembly	1023B
Rocker; for Interlocking Machine—Style "A" Locking	1503
Supports and Caps for Vertical Connections on Signals—details	1022B
Hand Lantern	1046A
Hand Lantern Globes	1611D
Handle and Alignment Clamp, Highway Crossing Gate Lamp	1498
Handrails, Ladder—details and assembly	1363
Hanger Sockets, Cable; Sewer Steps and Manhole Clevis	1334
Hangers, Lamp; Highway Crossing Gate and Slow Track Sign	1496
Hardware, Pole Line, Cross-Arms, etc.—See Part 51, Specification Section.	
Highway Crossing Flashing Light Signal Assembly—Cantilever Type	1686A
Highway Crossing Gate	
And Slow Track Sign Lamp Hangers	1496
Lamp	1499B
Fount and Lens Hoods	1497B
Handle and Alignment Clamp	1498
Highway Crossing Sign, 50 Deg. Reflector Type	1691A
Assembly	1692A
Details	1693A
Highway Crossing Signal Assembly	
Flashing Light Type	1653B, 1654B
Wig-Wag Type	1651B, 1652B
Highway Crossing Signal, Wig-Wag; Disc for	1553
Highway Crossing Signals, Flashing Light; Junction Box and Cross-Arm for	1656B
Details	1657B
Highway Crossings—Railroad Crossings—Insulated Joint Location	1636B
Highway Crossings, Tracks and—Graphical Symbols	1662A
Hoods, Lens	
And Couplings for Switch and Semaphore Lamps	1442B
Highway Crossing Gate Lamp Fount and	1497B
Horizontal	
Adjustable Deflecting Stands—details and assembly	1396A
Crank Stands	
Assembly, Two-Way, with Three-Way Stand and Single Pin	1057C
Concrete Foundation for	1103A
One-Way Assembly	1011C
One-Way—details	1008B
Two-Way Separate Pin—details and assembly	1393B
Pipe Compensator, One-Way—details and assembly	1014C
Hydrometer—stationary lead type storage battery	1175
I-Beams for Tower Leadouts, Details of Channels and	1202
Incandescent Electric Lamps and Adapter	1544B
Indicator, Take Siding—Dimensions and Lettering	1551
Indicators and Locks—Graphical Symbols	1679A
Instructions for Applying Compensation	1536
Instrument Cases	
Base for	
Style "A"	1629A
Styles "B" and "C"	1630A
Style "A"	1626B
Style "B"	1627B
Style "C"	1628B

Title	Drawing No.
Insulated	
Iron Line Wire Joint, Weatherproof	1405
Joint Location	
Automatic Signals and Interlocking	1634B
Car Retarder Layout	1639A
Electric Operation Territory	1637B
Non-Interlocked Switches	1635B
Railroad Crossings—Highway Crossings	1636B
Slip Switches and Frogs, Single or Double Rail Circuits	1638A
Switch Adjustment—assembly	1392C
Wire Joint	1406B
Insulation	
Gage-Plate—Butt Joint	
For 7″ Plate	1373C
For 8″ and 9″ Plate	1380A
Gage-Plate—Lap Joint	1454B
Pipe-Line for One-Inch Pipe	1094C
Switch-Rod	1055C
Interlocking	
Automatic Signals and—Insulated Joint Location	1634B
Machine	
Mechanical; Lever Number Plate for	1504B
Style "A" Locking	
Latch Shoe Assembly for	1502
Latch Shoe Details for	1501
Machine Leg for	1500
Rocker Guide for	1503
Iron	
Crossing Sign, Cast, 90 Deg.	1640B
Line Wire Joint, Insulated; Weatherproof	1405
Track Sign, Cast	1644B
Washer, Cast; for Three-Fourths Inch and Seven-Eighths Inch Bolts	1458C
Jars and Covers, Primary Battery	
Rectangular	1418A, 1419B
Round	1053B
Jaw Pins, Crank and	1010E
Jaws	
Screw and Solid—details	1016B
Screw; Tang Ends with	1360
Solid, with Tang Ends—assembly	1018
Tang End and Adjustable Link—details and assembly	1019B
Joint	
Butt—Gage-Plate Insulation	
For 7″ Plate	1373C
For 8″ and 9″ Plate	1380A
Insulated	
Iron Line Wire; Weatherproof	1405
Location	
Automatic Signals and Interlocking	1634B
Car Retarder Layout	1639A
Electric Operation Territory	1637B
Non-Interlocked Switches	1635B
Railroad Crossings—Highway Crossings	1636B

Title	Drawing No.
Joint—Continued	
Insulated, Location—Continued	
Slip Switches and Frogs, Single or Double Rail Circuits	1638A
Wire	1406B
Lap—Gage-Plate Insulation	1454B
Sleeve Type, Copper Line Wire; Weatherproof	1407
Stranded Wire	1408
Junction Box and Cross-Arm for Flashing Light Highway Crossing Signals	1656B
Details	1657B
Ladder	
Clamps and Stays—details and assembly	1371B
Foundation	1052
Handrails—details and assembly	1363
Parts	1585B
Details	1362B
Platforms—details and assembly	1364B
Ladders and Platform Parts for Light Signal Masts—details and assembly	1619A
Ladders for	
Bridge Masts	1366B
Ground Mast Signals—assembly	1365B
Ground Masts—assembly	1583B
Light Signal Masts—assembly	1620A
Two-Way Single-Lamp Signal	1357B
Lamp	
Bracket	
Adjustable; Details and Assembly of	1049A
Double Spectacle Bearing and—for two-way single-lamp signal	1356
Support, Spectacles and; Mechanical Dwarf Signal—details and assembly	1233
Case, Electric (Semaphore Signals)	1563B, 1564B
For Semaphore Lighting	1446A
Details	1592A, 1593A, 1594A, 1595A, 1596A
Disc, Switch	1445C
Engine Signal	1480B
Fount and Lens Hoods; Highway Crossing Gate	1497B
Handle and Alignment Clamp; Highway Crossing Gate	1498
Hangers, Slow Track Sign; Highway Crossing Gate and	1496
Highway Crossing Gate	1499B
Incandescent Electric, and Adapter	1544B
Semaphore	
Lens Hoods and Couplings for Switch and	1442B
Oil Fount	1101B
One Lens	1100B
Two Lens	1430B
Switch	
And Semaphore; Lens Hoods and Couplings for	1442B
Base Socket	
For Cylindrical Type Switch Lamp	1461B
For Spherical Type Switch Lamp	1441
Cylindrical Type	1460B
Spherical Type	1440B
Oil Fount for	1443B
Train Marker	1470B

Title	Drawing No.
Lantern Globes, Hand	1611D
Lantern, Hand	1046A
Lap Joint—Gage-Plate Insulation	1454B
Latch Shoe and Latch Rod—for S. & F. Interlocking Machine	
Assembly	1565A
Details	1566A
Latch Shoe for Interlocking Machine—Style "A" Locking	
Assembly	1502
Details	1501
Laying Duct, Method of	
Single and Multiple	1336
Single and Sewer Pipe	1331
Layout, Car Retarder—Insulated Joint Location	1639A
Lead Type Stationary Storage Battery Hydrometer	1175
Lead Type Storage Battery Thermometer	1375B
Leadouts, Bolt Locks and Stands—Graphical Symbols	1668A
Leadouts, Tower	
Foundation for	
Crank, Deflecting Bars and Rocking Shafts	1217
Cranks and Deflecting Bars	1203
Rocking Shafts	1200
Mounted	
Cranks and Deflecting Bars	1204
Deflecting Bars and Rocking Shafts	1206
Rocking Shafts	1201
Low Bearings	1207
Leadouts, Tower; Details of	
Channels and I-Beams	1202
Mountings for Cranks or Deflecting Bars	1205B
Leg, Machine; for Interlocking Machine—Style "A" Locking	1500
Lens Hoods	
And Couplings for Switch and Semaphore Lamps	1442B
Highway Crossing Gate Lamp Fount and	1497B
Lettering, Dimensions and—Take Siding Indicator	1551
Letters, Numerals and	1557A
Brackets for	1558A
Lever Number Plate for Mechanical Interlocking Machines	1504B
Light, Flashing, Signal Assembly; Highway Crossing—Cantilever Type	1686A
Light, Flashing, Type; Highway Crossing Signal Assembly	1653B, 1654B
Light Signal Masts	1616A, 1617A, 1618A
Ladders and Platform Parts—details and assembly	1619A
Ladders for—assembly	1620A
Light Signal Units to Masts, Application of	1621A
Lighting, Semaphore; Electric Lamp Case For	1446A
Lights, Marker; Details and Assembly of	1238A
Line	
Air Pipe; Concrete Foundations for	1081A
Insulation, Pipe—for one-inch pipe	1094C
Pipe and Wire—Graphical Symbols	1669A

Title	Drawing No.
Line—Continued	
Wire	
And Pipe—Graphical Symbols	1669A
Branch Connection to	
Dead-Ended Double Cross-Arm Support	1411
Double Cross-Arm Support	1403
Single Cross-Arm Support	1404
Joint, Insulated; Weatherproof	1405
Sleeve Type Joint; Weatherproof Copper	1407
Link	
Adjustable Jaws—Tang End and—details and assembly	1019B
Compensator, Tang End—Lug and—details and assembly	1017B
Location, Insulated Joint	
Automatic Signals and Interlocking	1634B
Car Retarder Layout	1639A
Electric Operation Territory	1637B
Non-Interlocked Switches	1635B
Railroad Crossings—Highway Crossings	1636B
Slip Switches and Frogs, Single or Double Rail Circuits	1638A
Lock	
Bolt, Leadouts and Stands—Graphical Symbols	1668A
Bolt, Multiple-Unit; Details and Assembly of	1095C
Plunger Switch—Rectangular Plunger	1425C
Details	1426C
Rod, Adjustable	1587A
Locking	
Bar Splice—S. & F. Machine	1586A
Details of, for S. & F. Machine	1599A, 1600A
Locks, Indicators and—Graphical Symbols	1679A
Low	
Bearings; Mounted Rocking Shafts for Tower Leadouts	1207
Rocking Shaft Bearing	1063
Target Stand—details and assembly	1399B
Lug and Compensator Link, Tang End—details and assembly	1017B
Lug, Switch Circuit Controller	1255C
Machine	
Interlocking—Style "A" Locking	
Latch Shoe Assembly for	1502
Latch Shoe Details for	1501
Machine Leg for	1500
Rocker Guide for	1503
Mechanical Interlocking; Lever Number Plate for	1504B
S. & F.	
Details of Locking	1599A, 1600A
Locking Bar Splice	1586A
Wall	
One-Way; Base for	1552B
Two-Lever	
Details	1397
Details and Assembly	1197
Mandrels, Duct Plugs and Dowel Pins; Duct Reducers	1332
Manganese Frogs, Bonding	1556

Title	Drawing No.
Manhole	
Brick	1338
Clevis, Cable Hanger Sockets, Sewer Steps and	1334
Concrete	1337
Frame and Cover	
4 in. High	1339
10 in. High	1333
Marker	
Crossing Signal, Reflector	1649A
Grade Signal	1612A
Lamp, Train	1470B
Lights; Details and Assembly of	1238A
Spring Switch	1613A
Marking Wires, Tags for	1622A
Mast	
Application of Light Signal Units to	1621A
Bridge	
Clamps for Base of—details and assembly	1178B
Ladders for	1366B
Socket Base for	1036B
Five-Inch	
Socket Base for	1250A
Suspension Base for	1193A
Four-Inch	
Base for	1449B
Precast Foundation for—details and assemblies	1694A, 1695A
Ground, Ladders for—assembly	1583B
Signal	
Details and assembly	1035B
Ground	
Base for	1614A
Bottom Mechanism	
Adapter-Base for	1387
Foundation for	1259B
Clamp for Base of—details and assembly	1059A
Foundation for	1107C
Ladders for—assembly	1365B
Light	1616A, 1617A, 1618A
Ladders and Platform Parts for—details and assembly	1619A
Ladders for—assembly	1620A
"U" Bolt and Clamp for	1083
Measuring Ground Resistance, Methods of	1377B
Mechanical	
Dwarf Signal	
Assembly	1097, 1545B
Details	1567A, 1568A
Escapement Cranks and Blanking Shield	1412A
Fittings—details	1239
Foundation for	1615A
Spectacles and Lamp Bracket Support—details and assembly	1233
Top and Base Bearings—details	1232
Escapement Cranks and Blanking Shield—Dwarf Signal	1412A

Title	Drawing No.
Mechanical—Continued	
Ground Signal	
Adjusting Crank and Assembly	1361
One-Arm	1043D
Two-Arm	1044D
Interlocking Machines; Lever Number Plate for	1504B
Semaphore Bearing	
Details	1082
Details and Assembly	1194
Signals; Operating Connections for—details and assembly	1195
Mechanically Applied Rail Head Type Bonds and Track Circuit Connectors	1048A
Mechanism	
Electric Motor Switch Operating; Operating and Overload Curve Chart	1457B
Signal, and Contacts—Contacts Actuated by Signal Arms or Mechanisms—Graphical Symbols	1678A
Signals, Ground Mast Bottom	
Adapter-Base for	1387
Foundation for	1259B
Metal and Wire, Sheet; Gages for	1427B
Method of Laying Single and	
Multiple Duct	1336
Sewer Pipe Duct	1331
Methods of Measuring Ground Resistance	1377B
Miscellaneous Apparatus—Graphical Symbols	1681A
Mold, Pattern and, for Arbitration Test Bar	1623A
Motor, Electric, Switch Operating Mechanism; Operating and Overload Curve Chart	1457B
Mounted	
Cranks and Deflecting Bars for Tower Leadouts	1204
Deflecting Bars and Rocking Shafts for Tower Leadouts	1206
Rocking Shafts	
For Tower Leadouts	1201
Low Bearings	1207
Mountings for Cranks or Deflecting Bars for Tower Leadouts; Details of	1205B
Movable Point Frog and Double-Slip Switch Assembly: Attachment—Operating and Front Rods	1535
Movement, Switch, and Contacts—Contacts Actuated by Switch Points, Derails or Locking Connections—Graphical Symbols	1677A
Multiple	
Duct, Method of Laying Single and	1336
Track Sign	
Cast-Iron	1644B
Reflector	1645B
Unit	
Bolt Lock; Details and Assembly of	1095C
Terminal Block	1054A
Vertical Crank Stands; Details of	1067
Ninety Deg. Crossing Sign	
Cast-Iron	1640B
Reflector	
Assemblies	1642B
Details	1643B
Non-Insulated Switch Adjustment—assembly	1391C

Title	Drawing No.
Non-Interlocked Switches—Insulated Joint Location	1635B
Number Plate, Lever, for Mechanical Interlocking Machines	1504B
Numerals and Letters	1557A
Brackets for	1558A
Numerals for Track Signs; Details of	1650B
Oil Fount	
For Semaphore Lamp	1101B
For Spherical Type Lamp	1443B
One-Arm Mechanical Ground Signal	1043D
One-Inch	
Pipe	
Pipe-Line Insulation for	1094C
Stuffing Box for	1225B
Signal Pipe and Coupling	1015A
One-Lens Semaphore Lamp	1100B
One-Way	
Horizontal	
Crank Stand Assembly	1011C
Crank Stand—details	1008B
Pipe Compensator—details and assembly	1014C
Pipe Carriers	1074B
Wall Machine; Base for	1552B
Operating and Front Rods, Attachment	
Double-Slip Switch and Movable Point Frog Assembly	1535
Single Switch Assembly	1534
Operating and Overload Curve Chart	1457B
Operating Characteristics, Wayside Signal—Graphical Symbols	1660A
Operating Connections for Mechanical Signals—details and assembly	1195
Operation, Electric, Territory—Insulated Joint Location	1637B
Overload Curve Chart, Operating and	1457B
Parts, Ladder	1585B
Details	1362B
Parts, Platform, for Light Signal Masts; Ladders and	1619A
Pattern and Mold for Arbitration Test Bar	1623A
Petroleum Asphaltum, When Wires are Placed Underground in, Trunking to be Used	1156
Pin	
Channel	1086B
Crank and Jaw	1010E
Dowel; Duct Reducers, Mandrels, Duct Plugs and	1332
Pinnacle	
Short	1245A
Wide Sweep Cable	1251A
Pipe	
Adjusting Screws—details and assembly	1002
Carrier	
Assembly	1084B
Concrete Foundations for	1080
Details	1085B
One-Way	1074B

Title	Drawing No.
Pipe—Continued	
Carrier—Continued	
Transverse	
Assembly	1072B
Details	1073
Strap, Double Roller Type	1075B
Compensator	
Cranks—details	1013B
One-Way Horizontal—details and assembly	1014C
Duct, Sewer; Method of Laying Single and	1331
Four or Five-Inch; Bolts for Crossing Signs for	1655B
Ground, Rods and	1424B
Line Insulation—for one-inch pipe	1094C
Lines, Air; Concrete Foundations for	1081A
Lines, Wire and—Graphical Symbols	1669A
One-Inch	
Pipe-Line Insulation for	1094C
Signal; and Coupling	1015A
Stuffing Box for	1225B
Six-Inch; Crank Bearings and Clamps for—for two-way single-lamp signal	1398A
Pipes, Ground; Ground Rods and	1424B
Plate	
Designation; Relay Contact Post	1633B
Gage, Insulation—Butt Joint	
For 7″ Plate	1373C
For 8″ and 9″ Plate	1380A
Gage, Insulation—Lap Joint	1454B
Lever Number; for Mechanical Interlocking Machines	1504B
Platform Parts for Light Signal Masts, Ladders and—details and assembly	1619A
Platforms, Ladder—details and assembly	1364B
Plug Type Rail Bonds and Track Circuit Connectors	
Duplex Conductor	1632C
Single Conductor	1631C
Plugs, Duct, and Dowel Pins; Duct Reducers, Mandrels	1332
Plunger	
Lock	
Adjustable Lock Rod for	1587A
Switch—Rectangular Plunger	1425C
Details	1426C
Point Frog, Movable, and Double-Slip Switch Assembly: Attachment—Operating and Front Rods	1535
Pole Line Hardware, Cross-Arms, etc.—See Part 51, Specification Section.	
Post	
Anchor	1058B
Binding	1070E
Cable	1192A
Relay Contact, Designation Plate	1633B
Precast Foundation for 4-Inch Mast—details and assemblies	1694A, 1695A

Title	Drawing No.
Primary Battery	
Rectangular Jars and Cover	1418A, 1419B
Round Jars and Cover	1053B
Rail Bonds, Plug Type, and Track Circuit Connectors	
Duplex Conductor	1632C
Single Conductor	1631C
Rail Head Bonds and Track Circuit Connectors	
Mechanically Applied Type	1048A
Welded Type	1047A
Railroad Crossings—Highway Crossings—Insulated Joint Location	1636B
Railroad, Electric; Crossing with Steam Railroad, Bonding of	
One Rail of Electric Railroad Insulated from Crossing	1428
Rails of Electric Railroad Not Insulated	1429
Rectangular	
Jars and Cover—primary battery	1418A, 1419B
Plunger	
Plunger Switch Lock	1425C
Details	1426C
Reducers, Duct; Mandrels, Duct Plugs and Dowel Pins	1332
Reflector Crossing Sign	
50 Degree	1691A
Assembly	1692A
Details	1693A
90 Degree	
Assemblies	1642B
Details	1643B
Reflector Crossing Signal Marker	1649A
Reflector Multiple Track Sign	1645B
Reflector Stop on Red Signal Sign	1646B
Reflector Stop When Swinging Sign	1648B
Relay Contact Post Designation Plate	1633B
Relay Contacts—Graphical Symbols	1674A
Relays—Graphical Symbols	1673A
Resistance	
Adjustable—for testing	1422A
Ground, Methods of Measuring	1377B
Retarder, Car, Layout—Insulated Joint Location	1639A
Rocker Guide for Interlocking Machine—Style "A" Locking	1503
Rocking Shaft	
Arms	1060
Assembly and Details	1062
Bearing, Low	1063
Bearings	1061C
Foundation for Cranks, Deflecting Bars and; for Tower Leadouts	1217
Foundation for; for Tower Leadouts	1200
Mounted	
Deflecting Bars and; for Tower Leadouts	1206
For Tower Leadouts	1201
Low Bearings	1207
Rod	
Adjustable Lock	1587A
Ground, and Ground Pipes	1424B
Insulation, Switch	1055C
Rod, Latch, Latch Shoe and—for S. & F. Interlocking Machine	
Assembly	1565A
Details	1566A
Rods, Ground, and Ground Pipes	1424B

Title	Drawing No.
Rods, Operating and Front, Attachment	
Double-Slip Switch and Movable Point Frog Assembly	1535
Single Switch Assembly	1534
Rods, Switch Circuit Controller	1256A
Round Jars and Cover—primary battery	1053B
Roundels for Signals	1414
S. & F. Machine	
Details of Locking	1599A, 1600A
Locking Bar Splice	1586A
Screw	
And Solid Jaws—details	1016B
Jaws; Tang Ends with	1360
Pipe Adjusting—details and assembly	1002
Semaphore	
Bearings, Mechanical	
Details	1082
Details and Assembly	1194
Lamp	
Case, Electric	1446A, 1563B, 1564B
Lens Hoods and Couplings for Switch and	1442B
Oil Fount	1101B
One Lens	1100B
Two Lens	1430B
Lighting, Electric Lamp Case for	1446A
Signal Blades	
Enameled Steel	1548
Wood	1065B
Spectacle	1041B
Design "A"	1040B
Electric; Torque Curves for	1064
For Two-Way Single-Lamp Signal	1550A
Separate Pin Horizontal Crank Stand; Two-Way—details and assembly	1393B
Seven-Eighths Inch Bolt, Cast-Iron Washer for	1458C
Sewer	
Pipe Duct; Method of Laying Single and	1331
Steps and Manhole Clevis; Cable Hanger Sockets	1334
Shaft, Rocking	
Arms	1060
Assembly and Details	1062
Bearing, Low	1063
Bearings	1061C
Foundation for	
Crank, Deflecting Bars and; for Tower Leadouts	1217
For Tower Leadouts	1200
Mounted	
Deflecting Bars and; for Tower Leadouts	1206
For Tower Leadouts	1201
Low Bearings	1207
Sheet Metal and Wire, Gages for	1427B
Shield, Blanking; Mechanical Escapement Cranks and; Dwarf Signal	1412A
Shoe, Latch, and Latch Rod—for S. & F. Interlocking Machine	
Assembly	1565A
Details	1566A

Title	Drawing No.
Shoe, Latch; for Interlocking Machine—Style "A" Locking	
Assembly for	1502
Details for	1501
Short Pinnacles	1245A
Siding Indicator, Take—dimensions and lettering	1551
Sign, Crossing, Highway; 50 Degree Reflector Type	1691A
Assembly	1692A
Details	1693A
Sign, Crossing, 90 Deg.	
Cast-Iron	1640B
Reflector	
Assemblies	1642B
Details	1643B
Sign Lamp Hangers, Slow Track; Highway Crossing Gate and	1496
Sign, Reflector	
Stop on Red Signal	1646B
Stop When Swinging	1648B
Sign, Track, Multiple	
Cast-Iron	1644B
Reflector	1645B
Sign, Track, Numerals for; Details of	1650B
Signal	
Automatic, and Interlocking—Insulated Joint Location	1634B
Blades	
Enameled Steel	1548
Wood	1065B
Dwarf	
Mechanical	
Assembly	1097, 1545B
Details	1567A, 1568A
Escapement Cranks and Blanking Shield	1412A
Fittings—details	1239
Foundation for	1615A
Spectacles and Lamp Bracket Support—details and assembly	1233
Top and Base Bearings—details	1232
Ground Mast	
Bottom Mechanism	
Adapter-Base for	1387
Foundation for	1259B
Clamp for Base of—details and assembly	1059A
Foundation for	1107C
Ladders for—assembly	1365B
Highway Crossing, Assembly	
Flashing Light Type	1653B, 1654B
Wig-Wag Type	1651B, 1652B
Highway Crossing Flashing Light Assembly—Cantilever Type	1686A
Highway Crossing, Flashing Light; Junction Box and Cross-Arm for	1656B
Details	1657B
Highway Crossing, Wig-Wag; Disc for	1553
Lamp; Engine	1480B
Marker	
Crossing, Reflector	1649A
Grade	1612A

Title	Drawing No.
Signal—Continued	
Masts	
Base for Ground	1614A
Details and Assembly	1035B
Light	1616A, 1617A, 1618A
Ladders and Platform Parts for—details and assembly	1619A
Ladders for—assembly	1620A
Units; Application of, to Masts	1621A
"U" Bolt and Clamp for	1083
Mechanical Ground	
One-Arm	1043D
Two-Arm	1044D
Mechanical, Operating Connections for—details and assembly	1195
Mechanism and Contacts—Contacts Actuated by Signal Arms or Mechanisms—Graphical Symbols	1678A
Operating Characteristics, Wayside—Graphical Symbols	1660A
Pipe and Coupling; One-Inch	1015A
Roundels for	1414
Supports—Graphical Symbols	1661A
Two-Way Single-Lamp	1236C
Crank Bearings and Clamps for	1355
For Six-Inch Pipe for	1398A
Double Spectacle Bearing and Lamp Bracket for	1356
Ladders for	1357B
Semaphore Spectacle for	1550A
Vertical Connections on	
Guide Clamps for—details	1021
Guide Supports and Caps for—details	1022B
Guides for—assembly	1023B
Wig-Wag, Highway Crossing; Disc for	1553
Signs	
Adapter Clamp and Details for	1647C
Crossing	
Adapter Clamp for	1641B
Bolts for, for 4″ or 5″ Pipe	1655B
Track, Numerals for; Details of	1650B
Single	
And Multiple Duct; Method of Laying	1336
And Sewer Pipe Duct; Method of Laying	1331
Conductor Plug Type Rail Bonds and Track Circuit Connectors	1631C
Cross-Arm Support; Branch Connection to Line Wire	1404
Lamp Signal, Two-Way	1236C
Crank Bearings and Clamps for	1355
For Six-Inch Pipe	1398A
Double Spectacle Bearing and Lamp Bracket for	1356
Ladders for	1357B
Semaphore Spectacle for	1550A
Rail Circuits, or Double, Slip Switches and Frogs—Insulated Joint Location	1638A
Switch Assembly: Attachment—Operating and Front Rods	1534
Vertical Crank Stand; Details and Assembly of	1066B
Sleeve Type Joint, Copper Line Wire; Weatherproof	1407
Slip Switch, Double; and Movable Point Frog Assembly: Attachment—Operating and Front Rods	1535

Title	Drawing No.
Slip Switches and Frogs, Single or Double Rail Circuits—Insulated Joint Location	1638A
Slow Track Sign Lamp Hangers; Highway Crossing Gate and	1496
Socket Base for	
Bridge Mast	1036B
Five-Inch Mast	1250A
Sockets	
Base, Switch Lamp	
For Cylindrical Type Switch Lamp	1461B
For Spherical Type Switch Lamp	1441
Cable Hanger, Sewer Steps and Manhole Clevis	1334
Solid Jaws	
Screw and—details	1016B
With Tang Ends—assembly	1018
Specimen, Tension Test	1624A
Spectacle	
Clearance; Diagram of	1093
Double, Bearing and Lamp Bracket—for two-way single-lamp signal	1356
Mechanical Dwarf Signal, and Lamp Bracket Support—details and assembly	1233
Semaphore	1041B
Design "A"	1040B
Electric; Torque Curves for	1064
For Two-Way Single-Lamp Signal	1550A
Spherical Type Switch Lamp	1440B
Base Socket	1441
Oil Fount for	1443B
Splice, Locking Bar—S. & F. Machine	1586A
Spring Switch Marker	1613A
Staff Tip Adapter	1459
Stands	
Deflecting, Adjustable; Horizontal—details and assembly	1396A
Horizontal Crank	
Assembly, Two-Way, with Three-Way Stand and Single Pin	1057C
Concrete Foundation for	1103A
One-Way Assembly	1011C
One-Way—details	1008B
Two-Way Separate Pin—details and assembly	1393B
Leadout, Bolt Locks and—Graphical Symbols	1668A
Low Target—details and assembly	1399B
Vertical Crank	
Multiple; Details of	1067
Single; Details and Assembly of	1066B
Stationary Storage Battery, Lead Type, Hydrometer	1175
Stays, Ladder Clamps and—details and assembly	1371B
Steam Railroad, Electric Railroad Crossing with; Bonding of	
One Rail of Electric Railroad Insulated from Crossing	1428
Rails of Electric Railroad Not Insulated	1429

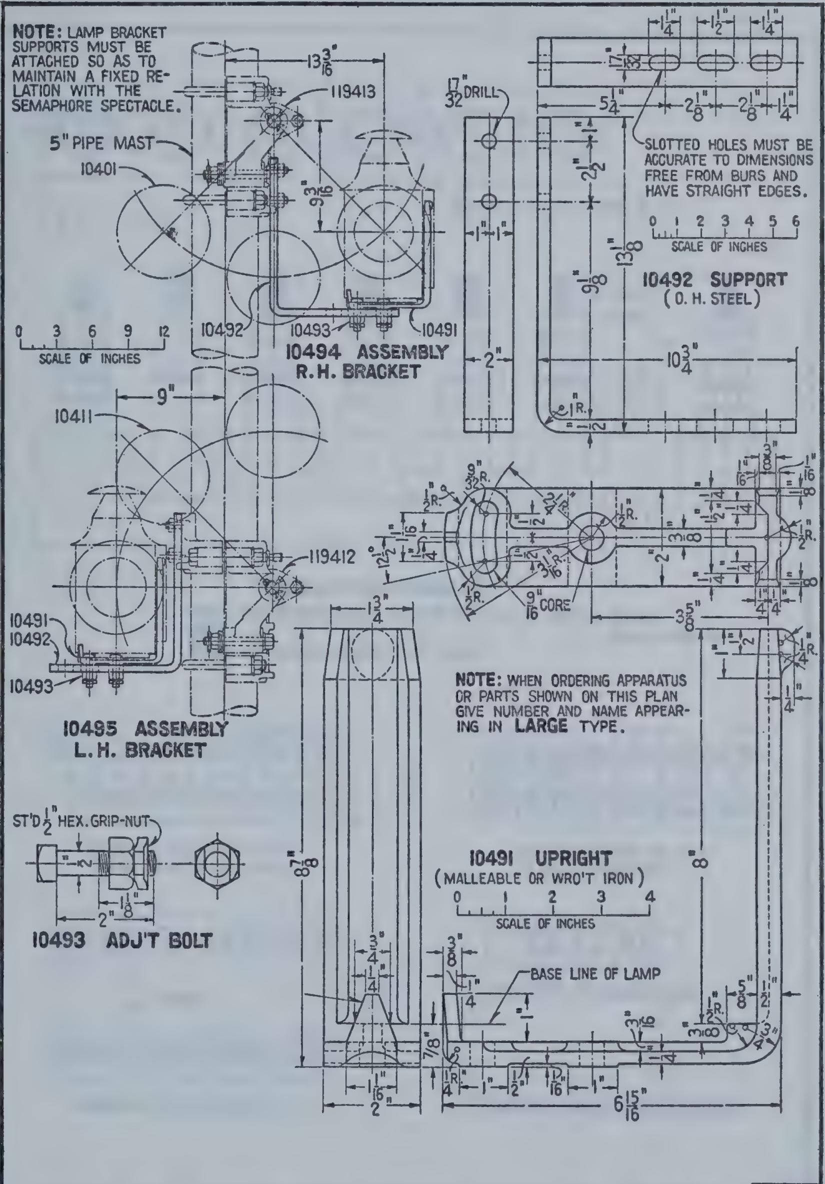
Title	Drawing No.
Steel Signal Blades; Enameled	1548
Steps, Sewer, and Manhole Clevis; Cable Hanger Sockets	1334
Stop on Red Signal Sign, Reflector	1646B
Stop When Swinging Sign, Reflector	1648B
Storage Battery, Lead Type Stationary, Hydrometer	1175
Storage Battery, Lead Type, Thermometer	1375B
Stranded Wire Joint	1408
Strap Pipe Carrier, Transverse, Double Roller Type	1075B
Stuffing Box for One-Inch Pipe	1225B
Style "A" Base for Instrument Case	1629A
Style "A" Instrument Case	1626B
Style "A" Locking, Interlocking Machine	
Latch Shoe	
Assembly for	1502
Details for	1501
Machine Leg for	1500
Rocker Guide for	1503
Style "B" and "C" Base for Instrument Cases	1630A
Style "B" Instrument Case	1627B
Style "C" Instrument Case	1628B
Supports	
And Caps for Vertical Connections on Signals; Guide—details	1022B
Cross-Arm	
Double	
Branch Connection to Dead-Ended Line Wire	1411
Branch Connection to Line Wire	1403
Single	
Branch Connection to Line Wire	1404
Lamp Bracket; Mechanical Dwarf Signal Spectacles and—details and assembly	1233
Signal—Graphical Symbols	1661A
Suspension Base for 5-Inch Mast	1193A
Switch	
Adjustment	
Details	1390C
Insulated—assembly	1392C
Non-Insulated—assembly	1391C
And Semaphore Lamps; Lens Hoods and Couplings for	1442B
Circuit Controller	
Connections	1254A
Lug	1255C
Rods	1256A
Double-Slip, and Movable Point Frog; Assembly: Attachment—Operating and Front Rods	1535
Lamp	
Base-Socket	
Cylindrical Type Switch Lamp	1461B
Spherical Type Switch Lamp	1441

Title — Drawing No.

Switch—Continued
  Lamp—Continued
    Cylindrical Type 1460B
    Disc 1445C
    Lens Hoods and Couplings for Switch and Semaphore 1442B
    Spherical Type 1440B
    Switch and Semaphore; Lens Hoods and Couplings for 1442B
  Lock, Plunger—Rectangular Plunger 1425C
    Details 1426C
  Marker, Spring 1613A
  Movement and Contacts—Contacts Actuated by Switch Points, Derails or Locking Connections—Graphical Symbols 1677A
  Non-Interlocked—Insulated Joint Location 1635B
  Operating Mechanism, Electric Motor Switch and; Operating and Overload Curve Chart 1457B
  Rod Insulation 1055C
  Single, Assembly: Attachment—Operating and Front Rods 1534
  Spring, Marker 1613A
Switches—Graphical Symbols 1665A
Switches, Slip, and Frogs, Single or Double Rail Circuits—Insulated Joint Location 1638A
Symbols, Graphical.—See Graphical Symbols.
Tags for Marking Wires 1622A
Take Siding Indicator—Dimensions and Lettering 1551
Tang End
  And Adjustable Link; Jaws—details and assembly 1019
  Double—details and assembly 1376
  Lug and Compensator Link—details and assembly 1017
  Solid Jaws with—assembly 1018
  With Screw Jaws 1360
Target Stand, Low—details and assembly 1399B
Tension Test Specimen 1624A
Terminal Block, Multiple Unit 1054A
Terminal Blocks—details and assembly 1056C
Territory, Electric Operation—Insulated Joint Location 1637B
Test Bar, Arbitration; Pattern and Mold for 1623A
Test Specimen Tension 1624A
Testing
  Adjustable Resistance for 1422A
  Apparatus; Torque 1456
Thermometer—lead type storage battery 1375B
Three-Fourths Inch Bolt, Cast-Iron Washer for 1458C
Tip Adapter, Staff 1459
Top and Base Bearings, Mechanical Dwarf Signal—details 1232
Torque
  Curves for Electric Semaphore Spectacles 1064
  Testing Apparatus 1456
Tower Leadouts
  Details of
    Channels and I-Beams 1202
    Mountings for Cranks or Deflecting Bars 1205B

Title	Drawing No.
Tower Leadouts—Continued	
Foundation for	
Crank, Deflecting Bars and Rocking Shafts	1217
Cranks and Deflecting Bars	1203
Rocking Shafts	1200
Mounted	
Cranks and Deflecting Bars	1204
Deflecting Bars and Rocking Shafts	1206
Rocking Shafts	1201
Low Bearings	1207
Track Appliances—Graphical Symbols	1667A
Track Circuit Connectors, Plug Type Rail Bonds and	
Duplex Conductor	1632C
Single Conductor	1631C
Track Circuit Connectors, Rail Head Bonds and	
Mechanically Applied Type	1048A
Welded Type	1047A
Track Sign	
Lamp Hangers, Slow; Highway Crossing Gate and	1496
Multiple	
Cast-Iron	1644B
Reflector	1645B
Numerals for; Details of	1650B
Tracks and Highway Crossings—Graphical Symbols	1662A
Train Marker Lamp	1470B
Transverse Pipe Carriers	
Assembly	1072B
Details	1073
Strap, Double Roller Type	1075B
Trunking	1156
Built-Up Type	1177
Grooved Type	1176
Tunnels; Buildings, Bridges and—Graphical Symbols	1663A
Two-Arm Mechanical Ground Signal	1044D
Two-Lens Semaphore Lamp	1430B
Two-Lever Wall Machine	
Details	1397
Details and Assembly	1197
Two-Way	
Horizontal Crank Stand Assembly with Three-Way Stand and Single Pin	1057C
Horizontal Crank Stand; Separate Pin—details and assembly	1393B
Single-Lamp Signal	1236C
Crank Bearing and Clamps for	1355
For 6-in. Pipe	1398A
Double Spectacle Bearing and Lamp Bracket for	1356
Ladders for	1357B
Semaphore Spectacle for	1550A
"U" Bolt and Clamp for Signal Masts	1083
Units, Light Signal; Application of, to Masts	1621A
Vertical	
Connections on Signals	
Guide Clamps for—details	1021
Guide Supports and Caps for—details	1022B
Guides for—assembly	1023B

Title	Drawing No.
Vertical—Continued	
Crank Stand	
Multiple; Details of	1067
Single; Details and Assembly of	1066B
Type—One-Way Pipe Compensator	1231
Vitrified Clay Duct	1335
Wall Machine	
One-Way; Base for	1552B
Two-Lever	
Details	1397
Details and Assembly	1197
Washer, Cast-Iron; for Three-Fourths Inch and Seven-Eighths Inch Bolts	1458C
Wayside Fixtures—Graphical Symbols	1664A
Wayside Signal Operating Characteristics—Graphical Symbols	1660A
Weatherproof	
Copper Line Wire, Sleeve Type Joint	1407
Insulated Iron Line Wire Joint	1405
Welded Type Rail Head Bonds and Track Circuit Connectors	1047A
Wide Sweep Cable Pinnacle	1251A
Wig-Wag Highway Crossing Signal, Disc for	1553
Wig-Wag Type Highway Crossing Signal Assembly	1651B, 1652B
Wire	
Gages for Sheet Metal and	1427A
Joint	
Insulated	1406B
Sleeve Type; Weatherproof Copper Line	1407
Stranded	1408
Weatherproof Insulated Iron Line	1405
Line; Branch Connection to	
Dead-Ended Double Cross-Arm Support	1411
Double Cross-Arm Support	1403
Single Cross-Arm Support	1404
Lines, Pipe and—Graphical Symbols	1669A
Tags for Marking	1622A
Wood Signal Blades	1065B


13 3/16"
119413
5" PIPE MAST
10401
9 3/16"
0 3 6 9 12
SCALE OF INCHES
10492
10493
10491
10494 ASSEMBLY
R. H. BRACKET
9"
10411
119412
10491
10492
10493
10495 ASSEMBLY
L. H. BRACKET
ST'D 1/2" HEX. GRIP-NUT
1/2"
1 1/8"
2"
10493 ADJ'T BOLT
17/32" DRILL
1"
1"
2"
1/4"
1/2"
1/4"
17/32"
5 1/4"
2 1/8"
2 1/8"
1 1/4"
1 1/4"
2 1/2"
13 1/8"
9 1/8"
10 3/4"
1 R.
1/2"
SLOTTED HOLES MUST BE ACCURATE TO DIMENSIONS FREE FROM BURS AND HAVE STRAIGHT EDGES.
0 1 2 3 4 5 6
SCALE OF INCHES
10492 SUPPORT
(O. H. STEEL)
9/32" R.
1/2" R.
12 1/2°
4 1/2" R.
1/2" R.
3 1/16" R.
1/2" R.
9/16" CORE
3 5/8"
3/8"
2"
1/8"
1/2" R.
1/4"
1 3/4"
8 7/8"
3/4"
1/4"
1 1/16"
2"
7/8"
1/2"
1/4" R.
8"
10491 UPRIGHT
(MALLEABLE OR WRO'T IRON)
0 1 2 3 4
SCALE OF INCHES
BASE LINE OF LAMP
3/8"
1/4"
1"
3/16"
3/8"
1/2" R.
5/8"
1/2"
4 1/2"
1/4" R.
1"
1/2"
1/16"
1"
6 15/16"

NOTE: LAMP BRACKET SUPPORTS MUST BE ATTACHED SO AS TO MAINTAIN A FIXED RELATION WITH THE SEMAPHORE SPECTACLE.

NOTE: WHEN ORDERING APPARATUS OR PARTS SHOWN ON THIS PLAN GIVE NUMBER AND NAME APPEARING IN **LARGE** TYPE.

DETAILS AND ASSEMBLY OF ADJUSTABLE LAMP BRACKET

ARA
SIG. SEC.
1049A

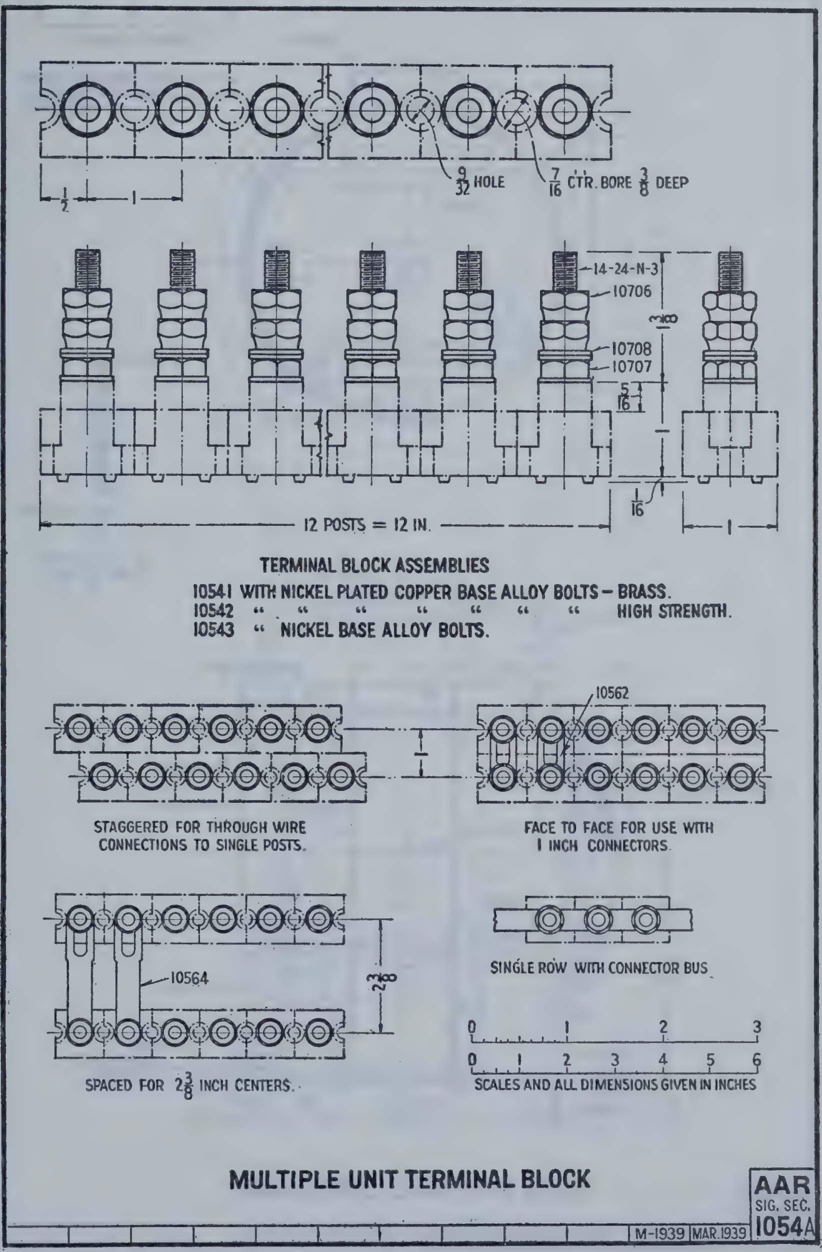
MAR. 1914 | OCT. 1910

See 1100 and 1596.

Malleable iron shall be in accordance with Specification for Malleable Iron Castings.

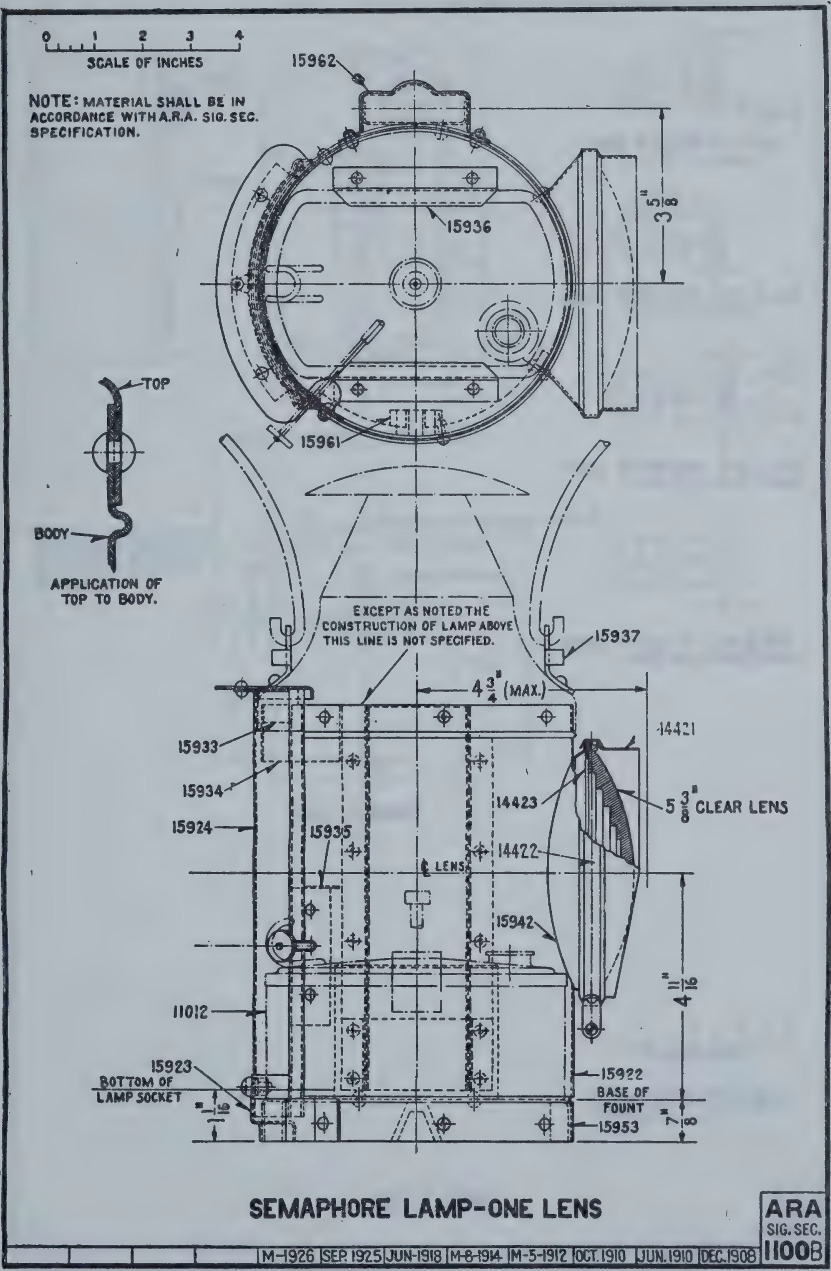
Wrought iron shall be in accordance with Specification for Refined Iron Bars.

Official Approval, July 1939.


9/32 HOLE
7/16 CTR. BORE 3/8 DEEP
1/2
1
14-24-N-3
10706
3 1/8
10708
10707
5/16
1/16
12 POSTS = 12 IN.
1
TERMINAL BLOCK ASSEMBLIES
10541 WITH NICKEL PLATED COPPER BASE ALLOY BOLTS – BRASS.
10542 " " " " " " " HIGH STRENGTH.
10543 " NICKEL BASE ALLOY BOLTS.
10562
1
STAGGERED FOR THROUGH WIRE CONNECTIONS TO SINGLE POSTS.
FACE TO FACE FOR USE WITH 1 INCH CONNECTORS.
10564
2 3/8
SPACED FOR 2 3/8 INCH CENTERS.
SINGLE ROW WITH CONNECTOR BUS
0 1 2 3
0 1 2 3 4 5 6
SCALES AND ALL DIMENSIONS GIVEN IN INCHES
MULTIPLE UNIT TERMINAL BLOCK
AAR
SIG. SEC.
1054A
M-1939
MAR. 1939

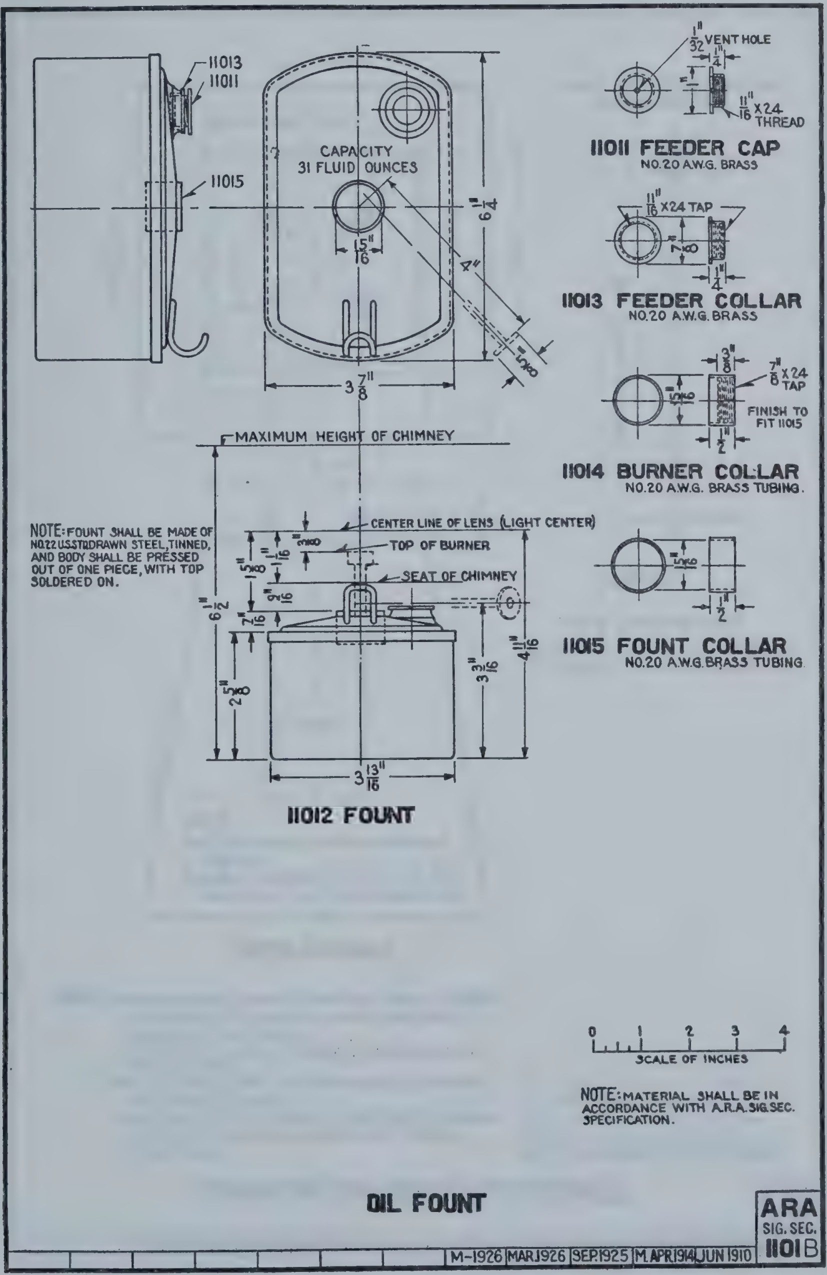
Material shall be in accordance with Specifications 159 and 183.

Official Approval, July 1926.


0 1 2 3 4
SCALE OF INCHES
NOTE: MATERIAL SHALL BE IN ACCORDANCE WITH A.R.A. SIG. SEC. SPECIFICATION.
15962
15936
3 5/8"
15961
TOP
BODY
APPLICATION OF TOP TO BODY.
EXCEPT AS NOTED THE CONSTRUCTION OF LAMP ABOVE THIS LINE IS NOT SPECIFIED.
15937
4 3/4" (MAX.)
14421
15933
15934
15924
14423
5 3/8" CLEAR LENS
15935
14422
℄ LENS
15942
4 11/16"
11012
15923
BOTTOM OF LAMP SOCKET
1 1/16"
15922
BASE OF FOUNT
7/8"
15953
SEMAPHORE LAMP-ONE LENS
ARA
SIG. SEC.
1100B
M-1926
SEP. 1925
JUN-1918
M-8-1914
M-5-1912
OCT. 1910
JUN. 1910
DEC. 1908

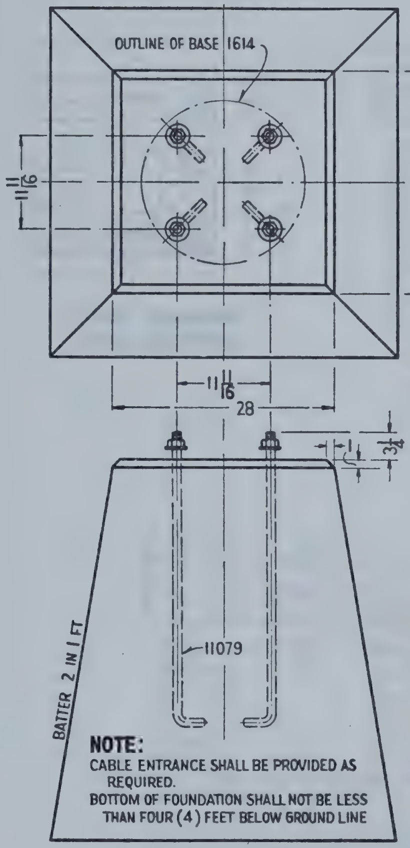
Material shall be in accordance with Specification 137.

Official
Approval,
July 1926.


11013
11011
11015
CAPACITY
31 FLUID OUNCES
6 1/4"
15/16"
4"
5/8"
3 7/8"
1/32" VENT HOLE
1/4"
1"
11/16" X24 THREAD
11011 FEEDER CAP
NO.20 A.W.G. BRASS
11/16" X24 TAP
7/8"
1/4"
11013 FEEDER COLLAR
NO.20 A.W.G. BRASS
3/8"
7/8" X24 TAP
15/16"
FINISH TO FIT 11015
1/2"
11014 BURNER COLLAR
NO.20 A.W.G. BRASS TUBING.
MAXIMUM HEIGHT OF CHIMNEY
CENTER LINE OF LENS (LIGHT CENTER)
TOP OF BURNER
SEAT OF CHIMNEY
NOTE: FOUNT SHALL BE MADE OF NO.22 U.S.STD.DRAWN STEEL, TINNED, AND BODY SHALL BE PRESSED OUT OF ONE PIECE, WITH TOP SOLDERED ON.
3/16"
1 5/8"
1/16"
9/16"
6 1/2"
7/16"
2 5/8"
3 3/16"
4 11/16"
3 13/16"
11012 FOUNT
15/16"
1/2"
11015 FOUNT COLLAR
NO.20 A.W.G. BRASS TUBING.
0 1 2 3 4
SCALE OF INCHES
NOTE: MATERIAL SHALL BE IN ACCORDANCE WITH A.R.A. SIG. SEC. SPECIFICATION.
OIL FOUNT
M-1926
MAR.1926
SEP.1925
M.APR.1914
JUN.1910
ARA
SIG. SEC.
1101B

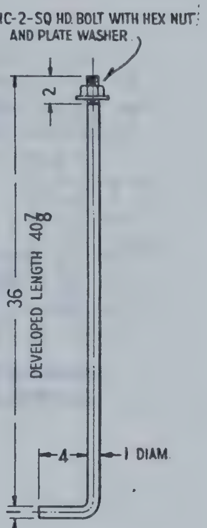
Material shall be in accordance with Specification 137.

Official Approval, Dec. 1923, Dec. 1935, July 1939.


OUTLINE OF BASE 1614
11 11/16
28
11 11/16
28
3 1/4
1
11079
BATTER 2 IN 1 FT

NOTE:
CABLE ENTRANCE SHALL BE PROVIDED AS REQUIRED.
BOTTOM OF FOUNDATION SHALL NOT BE LESS THAN FOUR (4) FEET BELOW GROUND LINE

11078 ASSEMBLY


1-8 NC-2-SQ HD. BOLT WITH HEX NUT AND PLATE WASHER.
2
36
DEVELOPED LENGTH 40 7/8
4
1 DIAM.

11079 ANCHOR BOLT

O.H. STEEL GALVANIZED OR CADMIUM PLATED AFTER THREADS HAVE BEEN CUT

NOTE: FOUNDATIONS SHALL BE MADE OF PORTLAND CEMENT CONCRETE IN ACCORDANCE WITH AMERICAN RAILWAY ENGINEERING ASSOCIATION SPECIFICATION.
COARSE AGGREGATE SHALL CONSIST OF $\frac{3}{4}$ INCH MAXIMUM SIZE STONE OR GRAVEL.
NOT LESS THAN 6 SACKS OF CEMENT SHALL BE USED PER CUBIC YARD OF CONCRETE.
WATER CEMENT RATIO TO PRODUCE A COMPRESSIVE STRENGTH OF 2500 POUNDS PER SQUARE INCH AFTER 28 DAYS SHALL BE USED.

0 6 12 24
0 6 12 18
SCALES AND ALL DIMENSIONS GIVEN IN INCHES

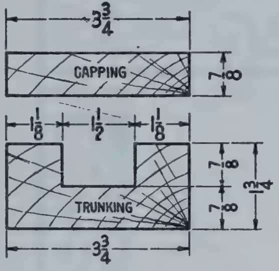
FOUNDATION FOR GROUND MAST SIGNALS

AAR
SIG. SEC.
1107C

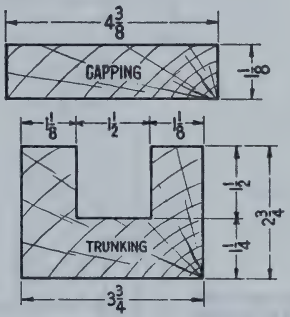
		M-1939	MAR.1939	M-1935	MAR.1935	M-1924	MAR.1923	NOV.1922	MAY 1916	M-3-1913	OCT.1909

PRINTED IN U. S. A.

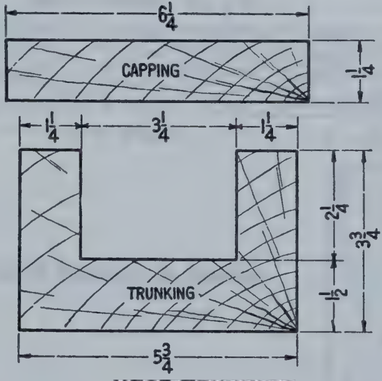
Official Approval, Nov. 1922.


3 3/4
CAPPING
7/8
1 1/8
1 1/2
1 1/8
7/8
7/8
1 3/4
TRUNKING
3 3/4

11761 TRUNKING
11762 CAPPING


4 3/8
CAPPING
1 1/8
1 1/8
1 1/2
1 1/8
1 1/2
1 1/4
2 3/4
TRUNKING
3 3/4

11763 TRUNKING
11764 CAPPING


6 1/4
CAPPING
1 1/4
1 1/4
3 1/4
1 1/4
2 1/4
3 3/4
1 1/2
TRUNKING
5 3/4

11765 TRUNKING
11766 CAPPING

SCALE AND ALL DIMENSIONS GIVEN IN INCHES

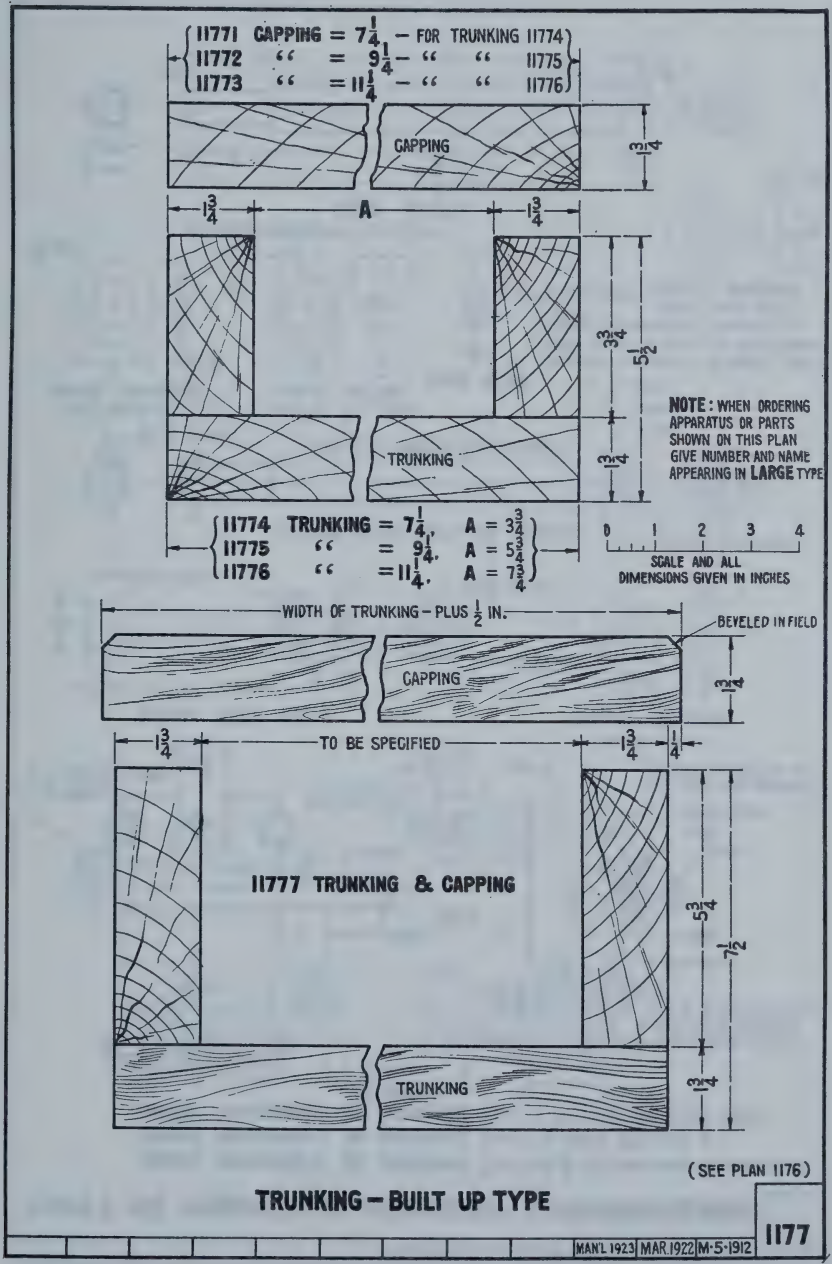
UNLESS OTHERWISE SPECIFIED ALL CAPPING AND TRUNKING SHALL BE SURFACED ON ALL SIDES, TOP AND BOTTOM - SEE SPECIFICATION.
WHEN ORDERING APPARATUS OR PARTS SHOWN ON THIS PLAN GIVE NUMBER AND NAME APPEARING IN **LARGE** TYPE.
(SEE PLAN 1177)

TRUNKING — GROOVED TYPE

MAN'L 1923 | MAR. 1922 | M-5-1912

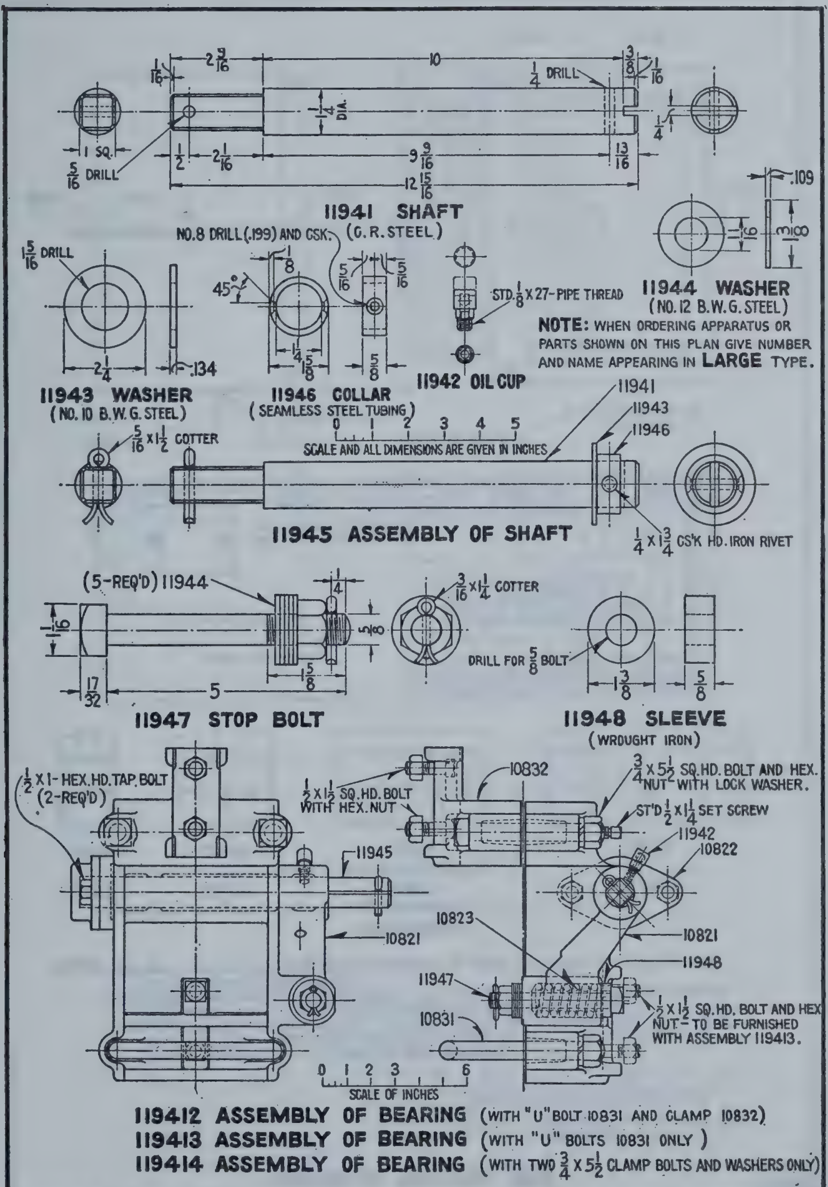
1176

Material shall be in accordance with Specification 57.


11771 CAPPING = 7 1/4 – FOR TRUNKING 11774
11772 " = 9 1/4 – " " 11775
11773 " = 11 1/4 – " " 11776
CAPPING
1 3/4
1 3/4
A
1 3/4
3 3/4
5 1/2
1 3/4
TRUNKING
NOTE: WHEN ORDERING APPARATUS OR PARTS SHOWN ON THIS PLAN GIVE NUMBER AND NAME APPEARING IN LARGE TYPE
11774 TRUNKING = 7 1/4, A = 3 3/4
11775 " = 9 1/4, A = 5 3/4
11776 " = 11 1/4, A = 7 3/4
0 1 2 3 4
SCALE AND ALL DIMENSIONS GIVEN IN INCHES
WIDTH OF TRUNKING – PLUS 1/2 IN.
BEVELED IN FIELD
CAPPING
1 3/4
1 3/4
TO BE SPECIFIED
1 3/4
1/4
11777 TRUNKING & CAPPING
5 3/4
7 1/2
TRUNKING
1 3/4
(SEE PLAN 1176)
TRUNKING – BUILT UP TYPE
MAN'L 1923
MAR. 1922
M-5-1912
1177

Material shall be in accordance with Specification 57.

Official Approval, Mar. 1921.


11941 SHAFT
(G.R. STEEL)
1 SQ.
5/16 DRILL
1/4 DRILL
1 1/4 DIA.
10
12 15/16
11943 WASHER
(NO. 10 B.W.G. STEEL)
1 5/16 DRILL
2 1/4
.134
NO. 8 DRILL (.199) AND CSK.
45°
11946 COLLAR
(SEAMLESS STEEL TUBING)
11942 OIL CUP
STD. 1/8 X 27-PIPE THREAD
11944 WASHER
(NO. 12 B.W.G. STEEL)
.109
NOTE: WHEN ORDERING APPARATUS OR PARTS SHOWN ON THIS PLAN GIVE NUMBER AND NAME APPEARING IN LARGE TYPE.
SCALE AND ALL DIMENSIONS ARE GIVEN IN INCHES
5/16 X 1 1/2 COTTER
11945 ASSEMBLY OF SHAFT
1/4 X 1 3/4 CS'K HD. IRON RIVET
(5-REQ'D) 11944
3/16 X 1 1/4 COTTER
11947 STOP BOLT
DRILL FOR 5/8 BOLT
11948 SLEEVE
(WROUGHT IRON)
1/2 X 1- HEX. HD. TAP. BOLT (2-REQ'D)
1/2 X 1 1/2 SQ. HD. BOLT WITH HEX. NUT
10832
3/4 X 5 1/2 SQ. HD. BOLT AND HEX. NUT WITH LOCK WASHER.
ST'D 1/2 X 1 1/4 SET SCREW
11942
10822
11945
10821
10823
11948
11947
10831
1/2 X 1 1/2 SQ. HD. BOLT AND HEX NUT - TO BE FURNISHED WITH ASSEMBLY 119413.
SCALE OF INCHES

119412 ASSEMBLY OF BEARING (WITH "U" BOLT 10831 AND CLAMP 10832)
119413 ASSEMBLY OF BEARING (WITH "U" BOLTS 10831 ONLY)
119414 ASSEMBLY OF BEARING (WITH TWO 3/4 X 5 1/2 CLAMP BOLTS AND WASHERS ONLY)

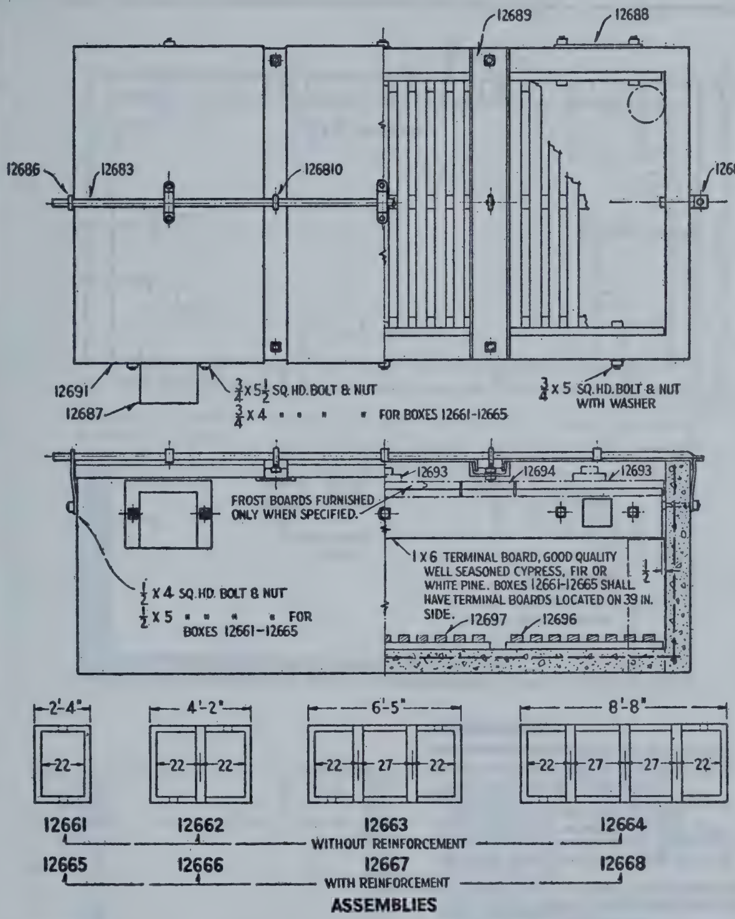
DETAILS AND ASSEMBLY OF MECHANICAL SEMAPHORE BEARING

1194

MAR. 1920 | MAR. 1917 | MAY. 1916 | MANUAL-FEB. 1914 | OCT. 1912

See 1082 and 1083 for further details.
Wrought iron shall be in accordance with Specification for Refined Iron Bars.

Official Approval, Aug. 1936, July 1939.


12689
12688
12686
12683
126810
12685
12691
12687
$\frac{3}{4}$ x 5$\frac{1}{2}$ SQ. HD. BOLT & NUT
$\frac{3}{4}$ x 4 " " " FOR BOXES 12661-12665
$\frac{3}{4}$ x 5 SQ. HD. BOLT & NUT WITH WASHER
12693
12694
12693
FROST BOARDS FURNISHED ONLY WHEN SPECIFIED.
1 X 6 TERMINAL BOARD, GOOD QUALITY WELL SEASONED CYPRESS, FIR OR WHITE PINE. BOXES 12661-12665 SHALL HAVE TERMINAL BOARDS LOCATED ON 39 IN. SIDE.
$\frac{1}{2}$
$\frac{1}{2}$ x 4 SQ. HD. BOLT & NUT
$\frac{1}{2}$ x 5 " " " FOR BOXES 12661-12665
12697
12696
2'-4"
4'-2"
6'-5"
8'-8"
22
22 22
22 27 22
22 27 27 22
12661
12662
12663
12664
WITHOUT REINFORCEMENT
12665
12666
12667
12668
WITH REINFORCEMENT
ASSEMBLIES

NOTES: ONE OUTLET CAP AND ONE OUTLET COVER WITH SCREEN OF THIRTY FIVE MESH COPPER TO FIT COVER SHALL BE PROVIDED WITH EACH BOX.

THE INSIDE SURFACE AND TOP EDGES OF BOX AND ALL SURFACES OF TERMINAL BOARDS, SLAT FLOOR AND FROST BOARDS SHALL BE GIVEN TWO COATS OF ASPHALTUM PAINT BEFORE INSTALLATION.

IRON WORK SHALL BE THOROUGHLY CLEANED AND GIVEN A PRIMING BRUSH OR DIPPING COAT OF RED OXIDE OR GRAPHITE PAINT. EXTERIOR IRON WORK SHALL BE GIVEN TWO COATS OF LIGHT GRAY PAINT AND INTERIOR IRON WORK SHALL BE GIVEN TWO COATS OF ASPHALTUM PAINT.

0 6 12 24 36
SCALE AND ALL DIMENSIONS GIVEN IN INCHES
0 3 6 9 12
SCALE OF FEET

CONCRETE BATTERY BOX

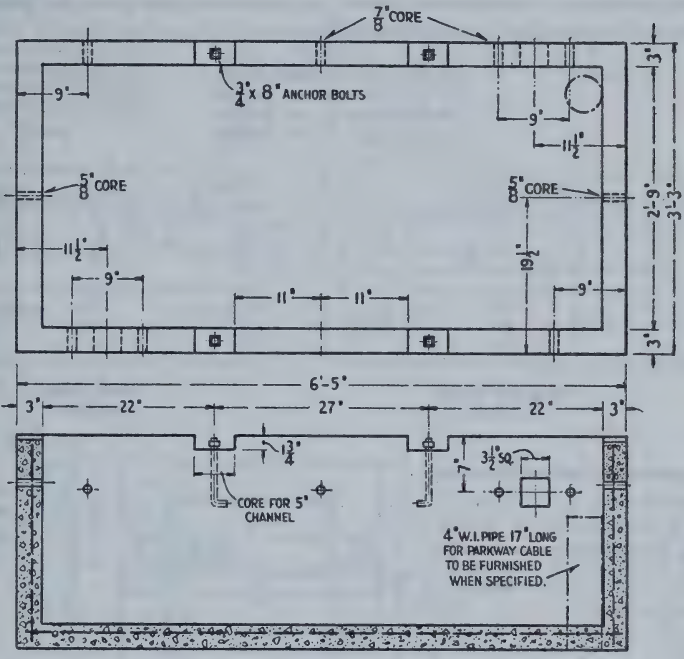
ASSEMBLIES

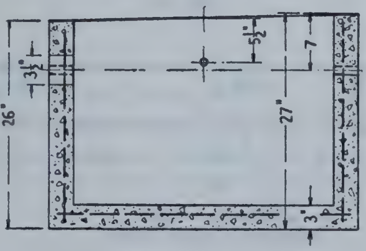
							M-1939	MAR. 1939	M-1936	MAR. 1936

AAR
SIG. SEC.
1266B

PRINTED IN U. S. A.

Official Approval, Aug. 1936, July 1939.


7/8" CORE
3/4" x 8" ANCHOR BOLTS
9"
9"
11 1/2"
5/8" CORE
5/8" CORE
11 1/2"
9"
19 1/2"
11"
11"
9"
3"
2'-9"
3'-3"
3"
6'-5"
3"
22"
27"
22"
3"
1 3/4"
7"
3 1/2" SQ.
CORE FOR 5" CHANNEL
4" W.I. PIPE 17" LONG FOR PARKWAY CABLE TO BE FURNISHED WHEN SPECIFIED.


3 1/2"
26"
5 1/2"
7"
27"
3"

REINFORCEMENT.

REINFORCEMENT WHEN SPECIFIED SHALL BE AS FOLLOWS:

REINFORCING MATERIAL SHALL BE DEFORMED 3/8 IN. ROUND STEEL ROD OR ITS EQUIVALENT.

REINFORCEMENT SHALL BE PLACED NOT LESS THAN 1 IN. FROM INSIDE OR OUTSIDE SURFACE OF BOX.

TWO REINFORCING RODS PROPERLY BENT SHALL FORM TWO COMPLETE REINFORCING BANDS AROUND TOP OF BOX ABOVE OUTLETS. ENDS OF EACH ROD SHALL LAP NOT LESS THAN 6 IN.

ONE REINFORCING ROD OF LENGTH 2 IN. LESS THAN THE HEIGHT OF WALL, SHALL BE PLACED VERTICALLY 2 IN. FROM INSIDE CORNER IN EACH WALL.

BOTTOM OF BOX SHALL BE REINFORCED LENGTHWISE AND CROSSWISE WITH REINFORCING RODS OF LENGTH 2 IN. LESS THAN OUTSIDE DIMENSION OF THE BOX AND SPACED NOT MORE THAN 12 IN. APART.

CONCRETE.

BOX SHALL BE MADE OF PORTLAND CEMENT CONCRETE IN ACCORDANCE WITH AMERICAN RAILWAY ENGINEERING ASSOCIATION SPECIFICATION.

COARSE AGGREGATE SHALL CONSIST OF 3/4 INCH MAXIMUM SIZE STONE OR GRAVEL.

NOT LESS THAN 7 SACKS OF CEMENT SHALL BE USED PER CUBIC YARD OF CONCRETE.

WATER CEMENT RATIO TO PRODUCE A COMPRESSIVE STRENGTH OF 3000 POUNDS PER SQUARE INCH AFTER 28 DAYS SHALL BE USED

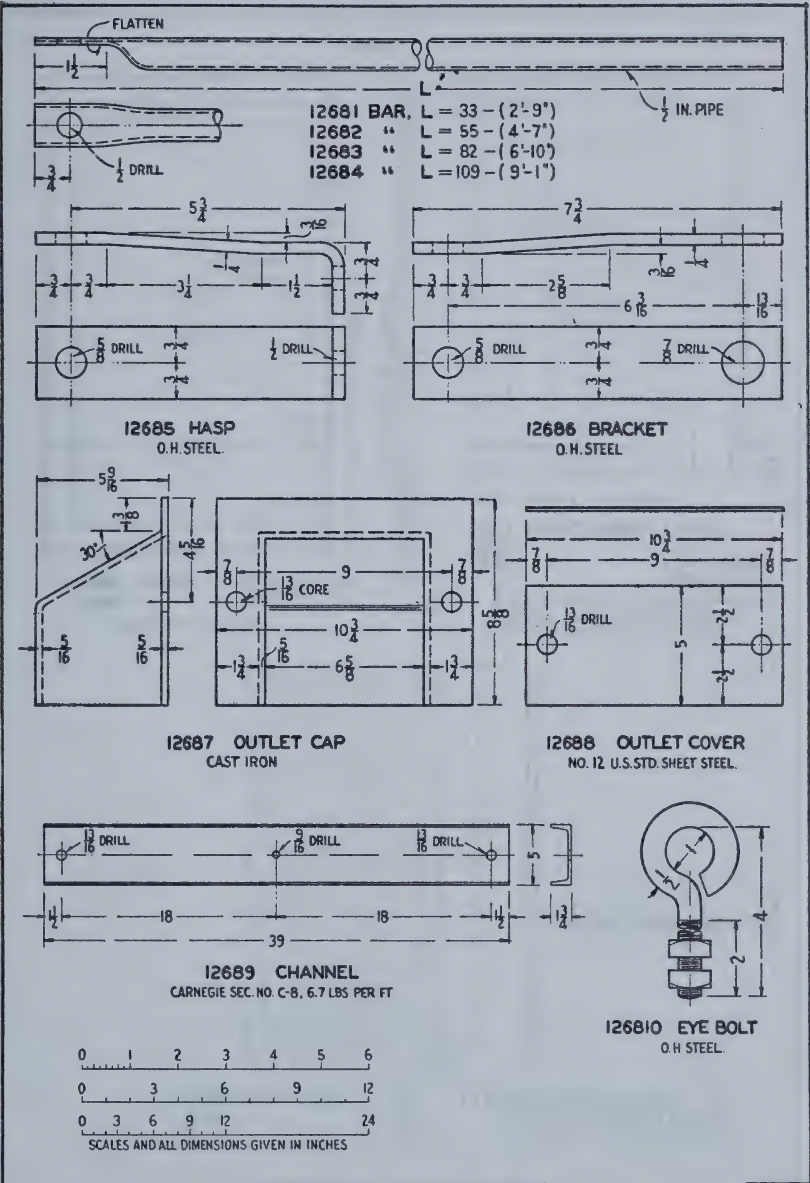
CONCRETE BATTERY BOX

DETAILS

AAR
SIG.SEC.
1267B

							M-1939	MAR.1939	M-1936	MAR.1936

Official Approval, Aug. 1936, July 1939.


FLATTEN
1½
L
½ IN. PIPE
½ DRILL
¾
12681 BAR, L = 33 – (2'-9")
12682 " L = 55 – (4'-7")
12683 " L = 82 – (6'-10")
12684 " L = 109 – (9'-1")
5¾
3/16
¼
¾
¾
3¼
1½
¾
¾
5/8 DRILL
¾
¾
½ DRILL
12685 HASP
O.H. STEEL.
7¾
3/16
¼
¾
¾
2⅝
6 3/16
13/16
5/8 DRILL
¾
¾
7/8 DRILL
12686 BRACKET
O.H. STEEL
5 9/16
3/8
30°
4 5/16
5/16
5/16
7/8
13/16 CORE
9
7/8
10¾
5/16
1¾
6⅝
1¾
8⅝
12687 OUTLET CAP
CAST IRON
10¾
7/8
9
7/8
13/16 DRILL
5
2½
2½
12688 OUTLET COVER
NO. 12 U.S.STD. SHEET STEEL.
13/16 DRILL
9/16 DRILL
13/16 DRILL
5
1½
18
18
1½
1¾
39
12689 CHANNEL
CARNEGIE SEC. NO. C-8, 6.7 LBS PER FT
1
½
4
2
126810 EYE BOLT
O.H STEEL.
0 1 2 3 4 5 6
0 3 6 9 12
0 3 6 9 12 24
SCALES AND ALL DIMENSIONS GIVEN IN INCHES

CONCRETE BATTERY BOX

DETAILS

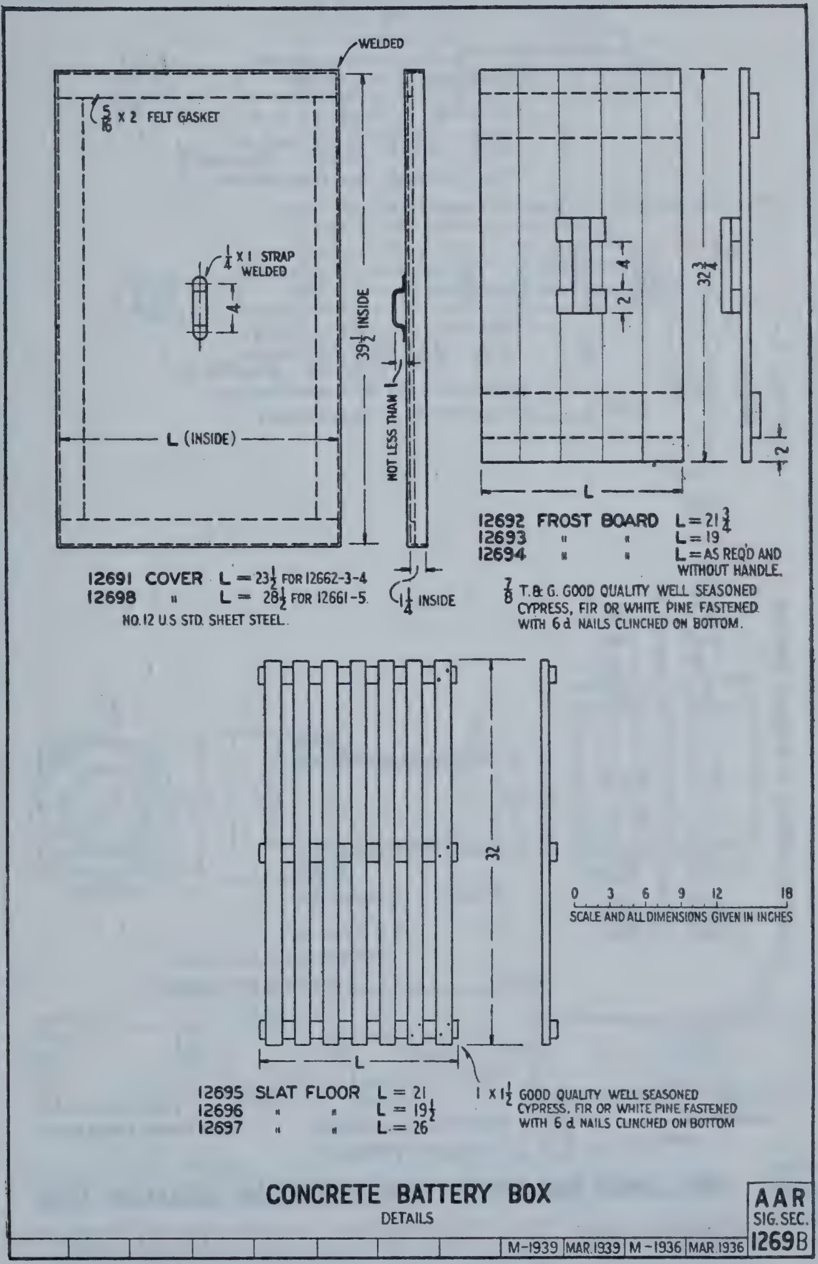
M-1939	MAR 1939	M-1936	MAR. 1936

AAR
SIG. SEC.
1268B

Material shall be in accordance with Specification 123 and Specification for Gray Iron Castings.

Association of American Railroads
Signal Section

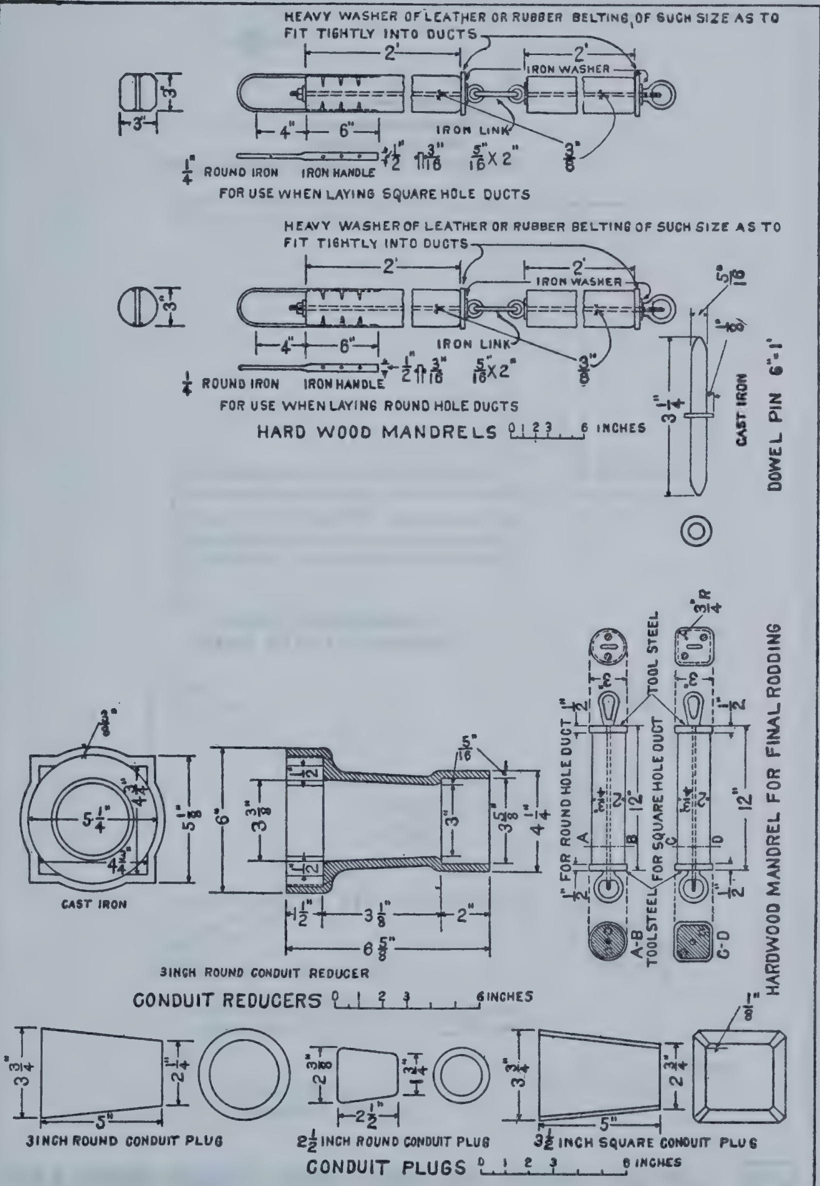
Official Approval, Aug. 1936, July 1939.


WELDED
5/16 X 2 FELT GASKET
1/4 X 1 STRAP WELDED
4
39 1/2 INSIDE
NOT LESS THAN 1
L (INSIDE)
1 1/4 INSIDE
12691 COVER L = 23 1/2 FOR 12662-3-4
12698 " L = 28 1/2 FOR 12661-5.
NO. 12 U.S. STD. SHEET STEEL.
4
2
32 3/4
2
L
12692 FROST BOARD L = 21 3/4
12693 " " L = 19
12694 " " L = AS REQ'D AND WITHOUT HANDLE.
7/8 T.& G. GOOD QUALITY WELL SEASONED CYPRESS, FIR OR WHITE PINE FASTENED WITH 6 d NAILS CLINCHED ON BOTTOM.
32
L
12695 SLAT FLOOR L = 21
12696 " " L = 19 1/2
12697 " " L = 26
1 X 1 1/2 GOOD QUALITY WELL SEASONED CYPRESS, FIR OR WHITE PINE FASTENED WITH 6 d NAILS CLINCHED ON BOTTOM
0 3 6 9 12 18
SCALE AND ALL DIMENSIONS GIVEN IN INCHES
M-1939 MAR. 1939 M-1936 MAR. 1936
AAR SIG. SEC. 1269B

CONCRETE BATTERY BOX

DETAILS

PRINTED IN U. S. A.

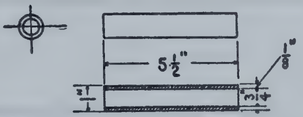

HEAVY WASHER OF LEATHER OR RUBBER BELTING OF SUCH SIZE AS TO FIT TIGHTLY INTO DUCTS
2'
2'
IRON WASHER
3"
3"
4"
6"
IRON LINK
1/4" ROUND IRON
IRON HANDLE
1/2"
3/16"
5/16" X 2"
3/8"
FOR USE WHEN LAYING SQUARE HOLE DUCTS
HEAVY WASHER OF LEATHER OR RUBBER BELTING OF SUCH SIZE AS TO FIT TIGHTLY INTO DUCTS
2'
2'
IRON WASHER
3"
4"
6"
IRON LINK
1/4" ROUND IRON
IRON HANDLE
1/2"
3/16"
5/16" X 2"
3/8"
FOR USE WHEN LAYING ROUND HOLE DUCTS
HARD WOOD MANDRELS 0 1 2 3 6 INCHES
5/16"
1/8"
3 1/4"
CAST IRON
DOWEL PIN 6"=1'
3/8"
5 1/4"
4 3/4"
4 3/4"
5 1/8"
6"
3 3/8"
1/2"
1/2"
5/16"
3"
3 5/8"
4 1/4"
1 1/2"
3 1/8"
2"
6 5/8"
CAST IRON
3INCH ROUND CONDUIT REDUCER
CONDUIT REDUCERS 0 1 2 3 6 INCHES
3/4"R
3"
TOOL STEEL
1/2"
1/2"
1 1/2"
1 1/2"
12"
12"
A
B
C
D
1" FOR ROUND HOLE DUCT
1" FOR SQUARE HOLE DUCT
1/2"
1/2"
TOOLSTEEL
A-B TOOLSTEEL
C-D
HARDWOOD MANDREL FOR FINAL RODDING
1/8"
3 1/4"
2 1/4"
5"
3INCH ROUND CONDUIT PLUG
2 3/8"
1 3/4"
2 1/2"
2 1/2 INCH ROUND CONDUIT PLUG
3 1/4"
2 3/4"
5"
3 1/2 INCH SQUARE CONDUIT PLUG
CONDUIT PLUGS 0 1 2 3 6 INCHES

DUCT REDUCERS, MANDRELS, DUCT PLUGS AND DOWEL PINS

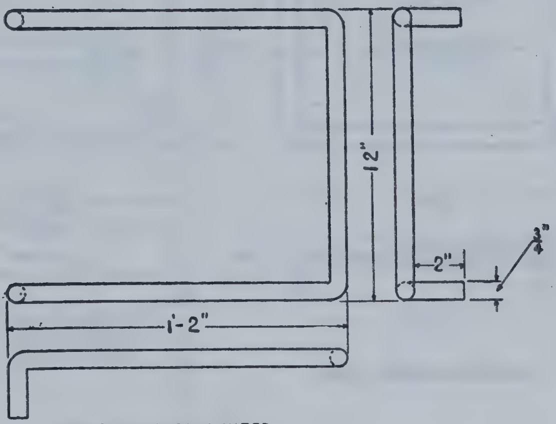
RSA 1332

SEP. 1914 MAY. 1914 OCT. 1913

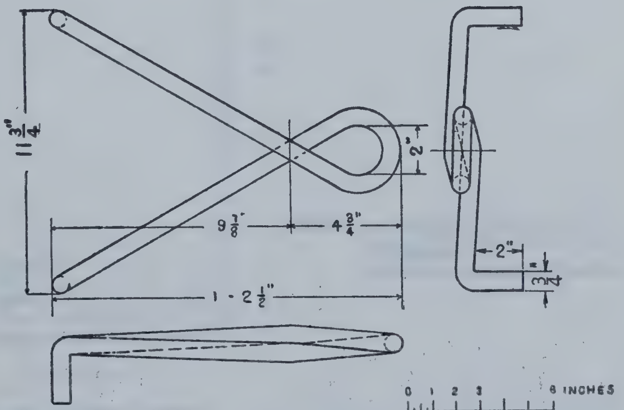
Cast iron shall be in accordance with Specification for Gray Iron Castings.
Wrought iron shall be in accordance with Specification for Refined Iron Bars.



GALVANIZED IRON PIPE
CABLE HANGER SOCKET FOR MANHOLES



WROUGHT IRON GALVANIZED
SEWER STEP FOR MANHOLES


11 3/4"
2"
9 7/8"
4 3/4"
1 - 2 1/2"
2"
3/4"
0 1 2 3 6 INCHES

WROUGHT IRON GALVANIZED
MANHOLE CLEVIS

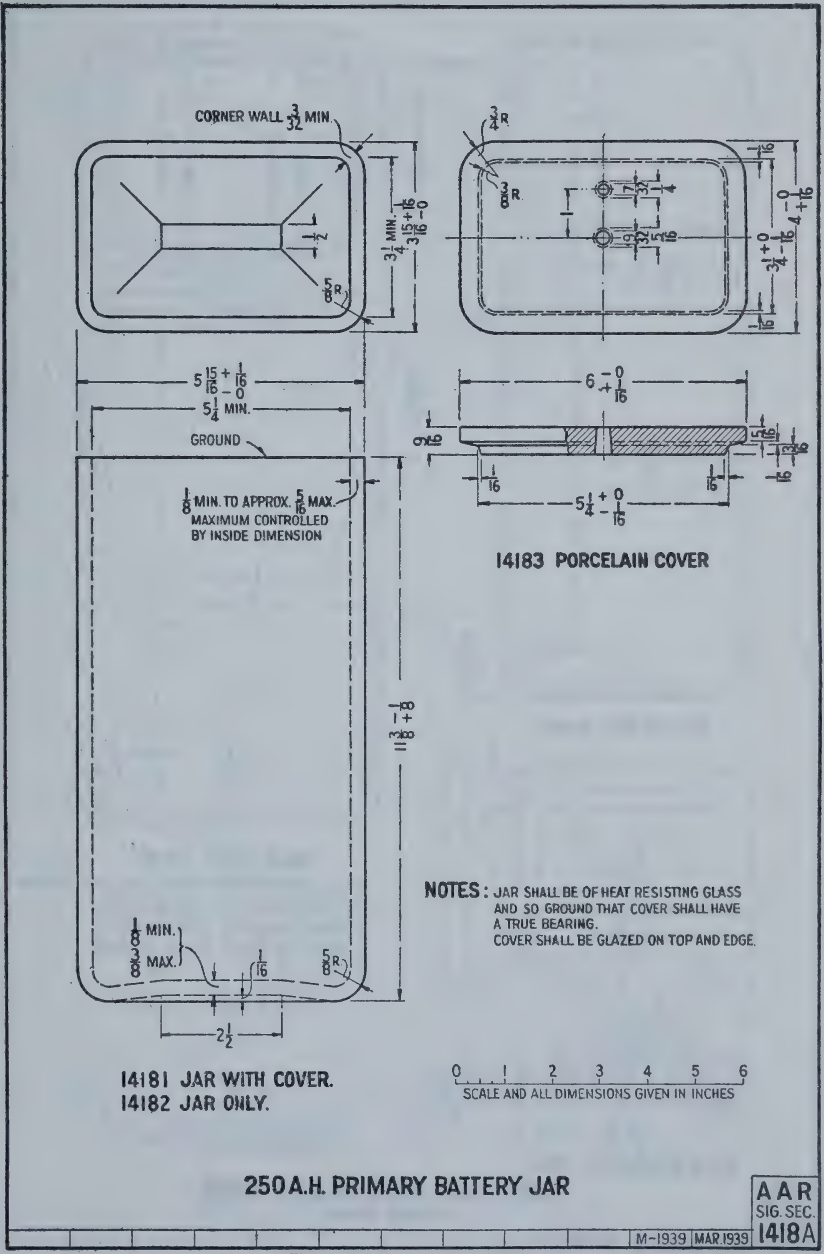
CABLE HANGER SOCKETS, SEWER STEPS AND MANHOLE CLEVIS

RSA 1334

SEP. 1914 OCT. 1913

Material shall be in accordance with Specification 123 and Specification for Refined Iron Bars.

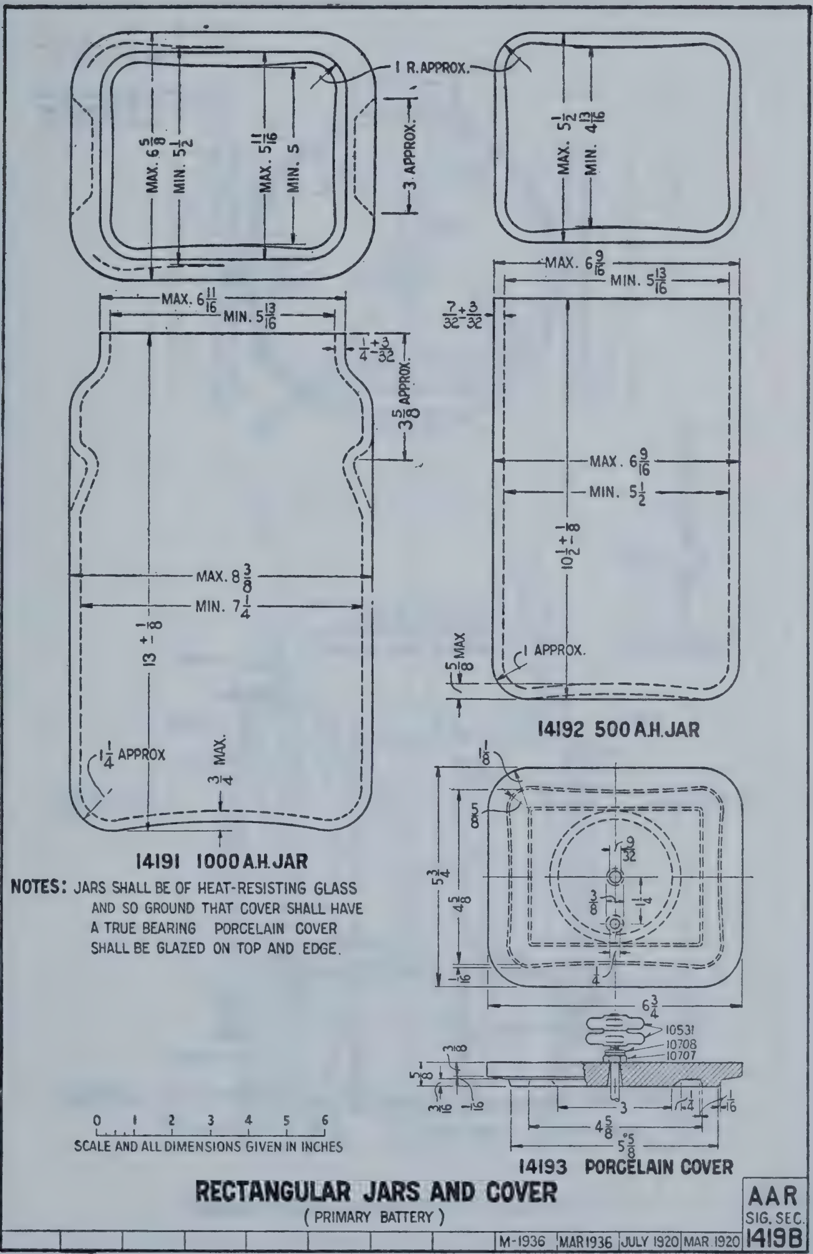
Official Approval, July 1939.


CORNER WALL 3/32 MIN.
1 1/2
5/8 R.
3 1/4 MIN.
3 15/16 +1/16 −0
3/4 R
3/8 R.
1
7/32
1/4
19/32
5/16
1/16
4 −0 +1/16
3 1/4 +0 −1/16
1/16
6 −0 +1/16
9/16
5/16
3/16
1/16
1/16
1/16
5 1/4 +0 −1/16
14183 PORCELAIN COVER
5 15/16 +1/16 −0
5 1/4 MIN.
GROUND
1/8 MIN. TO APPROX. 5/16 MAX. MAXIMUM CONTROLLED BY INSIDE DIMENSION
11 3/8 −1/8 +1/8
1/8 MIN.
3/8 MAX.
1/16
5/8 R.
2 1/2
14181 JAR WITH COVER.
14182 JAR ONLY.
0 1 2 3 4 5 6
SCALE AND ALL DIMENSIONS GIVEN IN INCHES
250 A.H. PRIMARY BATTERY JAR
AAR
SIG. SEC.
1418A
M-1939
MAR. 1939

NOTES: JAR SHALL BE OF HEAT RESISTING GLASS AND SO GROUND THAT COVER SHALL HAVE A TRUE BEARING.
COVER SHALL BE GLAZED ON TOP AND EDGE.

Material shall be in accordance with Specifications 113 and 144.

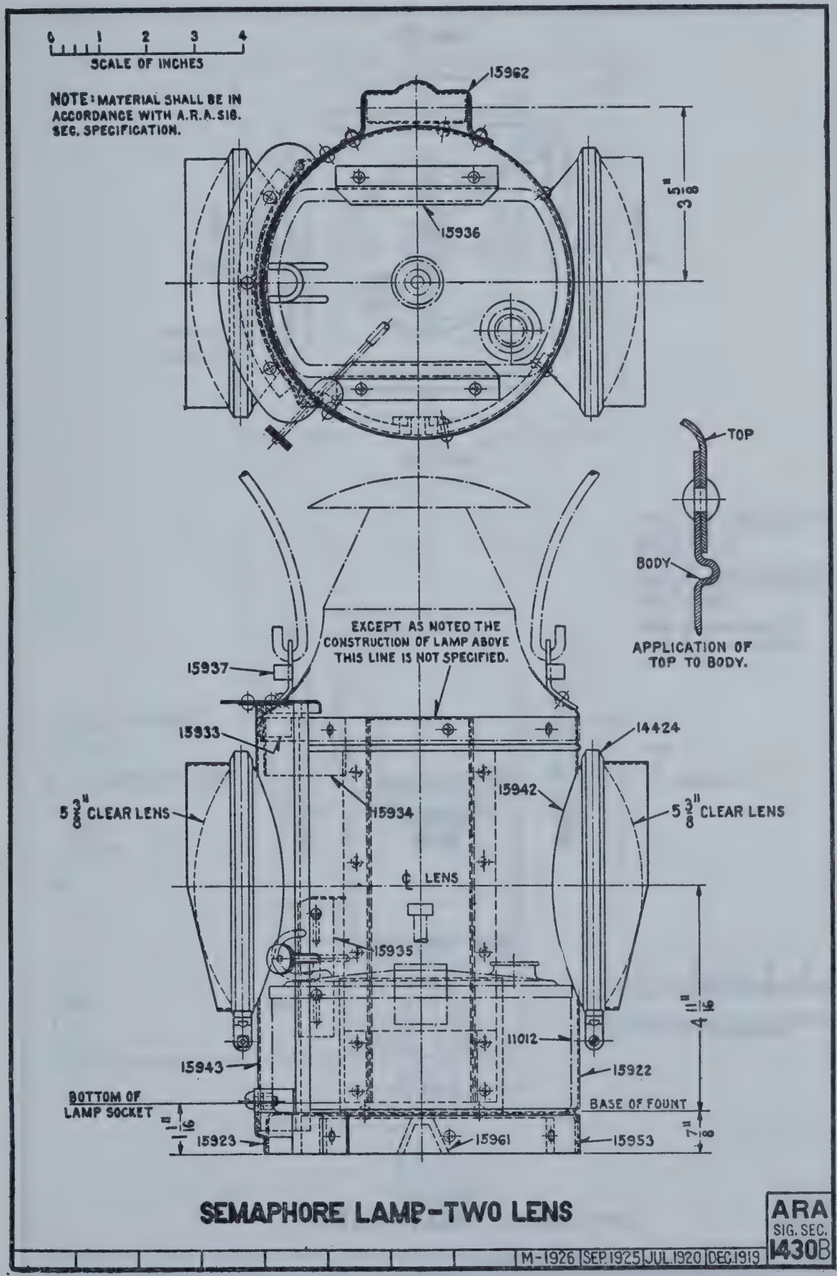
Official Approval, Mar. 1921, Aug. 1936.


I R. APPROX.
MAX. 6 5/8
MIN. 5 1/2
MAX. 5 11/16
MIN. 5
3 APPROX.
MAX. 5 1/2
MIN. 4 13/16
MAX. 6 11/16
MIN. 5 13/16
1/4 + 3/32
3 5/8 APPROX.
MAX. 8 3/8
MIN. 7 1/4
13 ± 1/8
1 1/4 APPROX
3/4 MAX.
14191 1000 A.H. JAR
NOTES: JARS SHALL BE OF HEAT-RESISTING GLASS AND SO GROUND THAT COVER SHALL HAVE A TRUE BEARING PORCELAIN COVER SHALL BE GLAZED ON TOP AND EDGE.
MAX. 6 9/16
MIN. 5 13/16
7/32 + 3/32
MAX. 6 9/16
MIN. 5 1/2
10 1/2 ± 1/8
5/8 MAX
1 APPROX.
14192 500 A.H. JAR
1/8
5/8
5 3/4
4 5/8
9/32
3/8
1 1/4
1/16
1/4
6 3/4
10531
10708
10707
3/8
5/8
3/16
1/16
3
1/4
1/16
4 5/8
5 5/8
14193 PORCELAIN COVER
0 1 2 3 4 5 6
SCALE AND ALL DIMENSIONS GIVEN IN INCHES
AAR
SIG. SEC.
1419B
M-1936
MAR 1936
JULY 1920
MAR 1920

RECTANGULAR JARS AND COVER
(PRIMARY BATTERY)

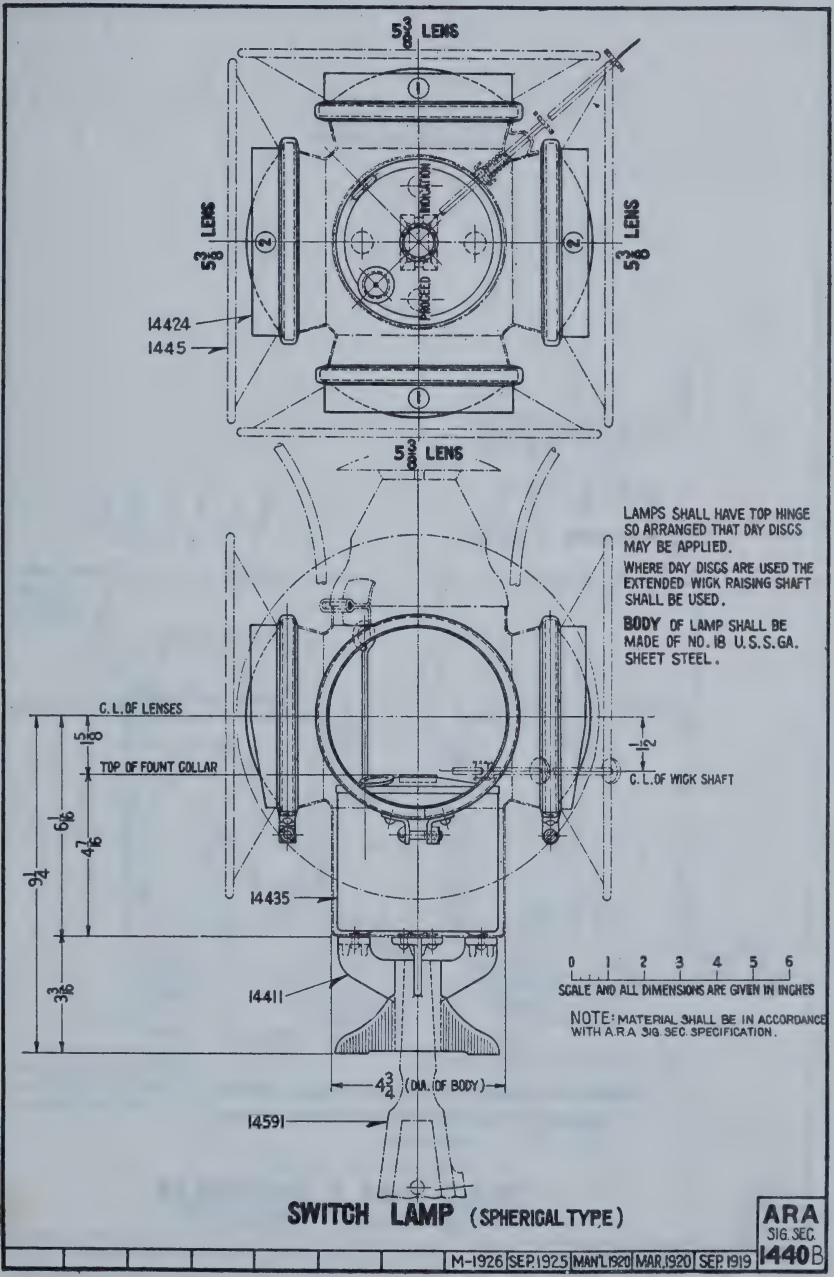
Material shall be in accordance with Specifications 113 and 144.

Official Approval, Mar. 1921, July 1926.


0 1 2 3 4
SCALE OF INCHES
NOTE: MATERIAL SHALL BE IN ACCORDANCE WITH A.R.A. SIG. SEC. SPECIFICATION.
15962
3 5/8"
15936
TOP
BODY
APPLICATION OF TOP TO BODY.
EXCEPT AS NOTED THE CONSTRUCTION OF LAMP ABOVE THIS LINE IS NOT SPECIFIED.
15937
15933
14424
15942
5 3/8" CLEAR LENS
15934
5 3/8" CLEAR LENS
℄ LENS
15935
4 11/16"
11012
15943
15922
BOTTOM OF LAMP SOCKET
BASE OF FOUNT
1/16"
15923
15961
15953
7/8"
SEMAPHORE LAMP-TWO LENS
ARA
SIG. SEC.
1430B
M-1926
SEP.1925
JUL.1920
DEC.1919

Material shall be in accordance with Specification 137.

Official
Approval,
Mar. 1921,
July 1926.


5 3/8 LENS
5 3/8 LENS
5 3/8 LENS
5 3/8 LENS
①
②
INDICATION
PROCEED
14424
1445
C. L. OF LENSES
1 5/8
TOP OF FOUNT COLLAR
9 1/4
6 1/16
4 7/16
3 3/16
1 1/2
C. L. OF WICK SHAFT
14435
14411
4 3/4 (DIA. OF BODY)
14591
0 1 2 3 4 5 6
SWITCH LAMP (SPHERICAL TYPE)
ARA
SIG. SEC.
1440B
M-1926
SEP. 1925
MAN'L 1920
MAR. 1920
SEP. 1919

LAMPS SHALL HAVE TOP HINGE SO ARRANGED THAT DAY DISCS MAY BE APPLIED.

WHERE DAY DISCS ARE USED THE EXTENDED WICK RAISING SHAFT SHALL BE USED.

BODY OF LAMP SHALL BE MADE OF NO. 18 U.S.S. GA. SHEET STEEL.

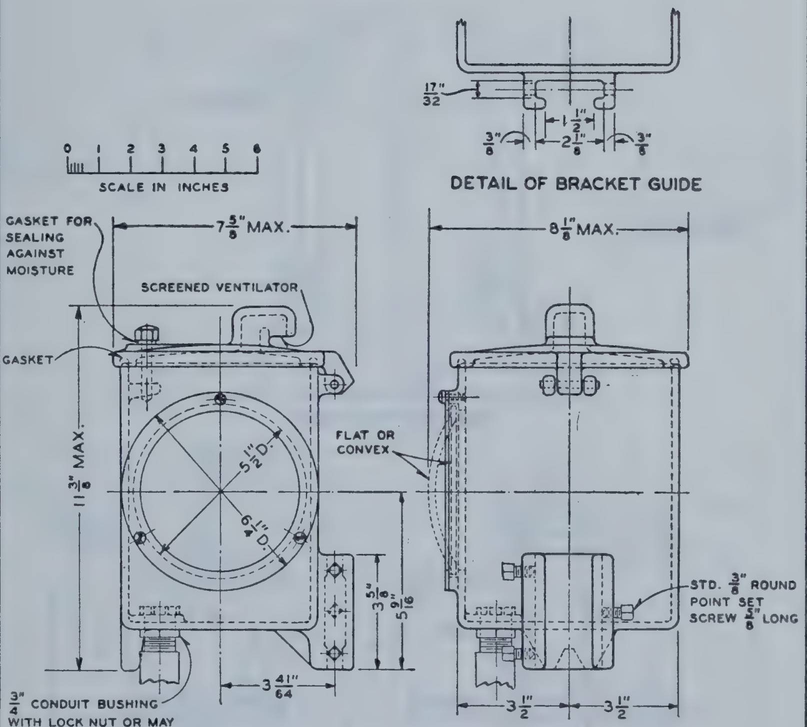
SCALE AND ALL DIMENSIONS ARE GIVEN IN INCHES

NOTE: MATERIAL SHALL BE IN ACCORDANCE WITH A.R.A SIG. SEC. SPECIFICATION.

Material shall be in accordance with Specification 137.

Official Approval, July 1937.

NOTE: BOLTS AND SCREWS, EXCEPT SET SCREWS, SHALL BE NON-CORRODIBLE METAL.


17"/32
1 1/2"
3"/8
2 1/8"
3"/8
DETAIL OF BRACKET GUIDE
0 1 2 3 4 5 6
SCALE IN INCHES
GASKET FOR SEALING AGAINST MOISTURE
7 5/8" MAX.
8 1/8" MAX.
SCREENED VENTILATOR
GASKET
11 3/8" MAX.
5 1/2" D.
6 1/4" D.
FLAT OR CONVEX
3 5/8"
5 9/16"
STD. 3/8" ROUND POINT SET SCREW 5/8" LONG
3 41/64"
3 1/2"
3 1/2"
3/4" CONDUIT BUSHING WITH LOCK NUT OR MAY BE CAST IN PLACE WITH LOCK NUT OMITTED

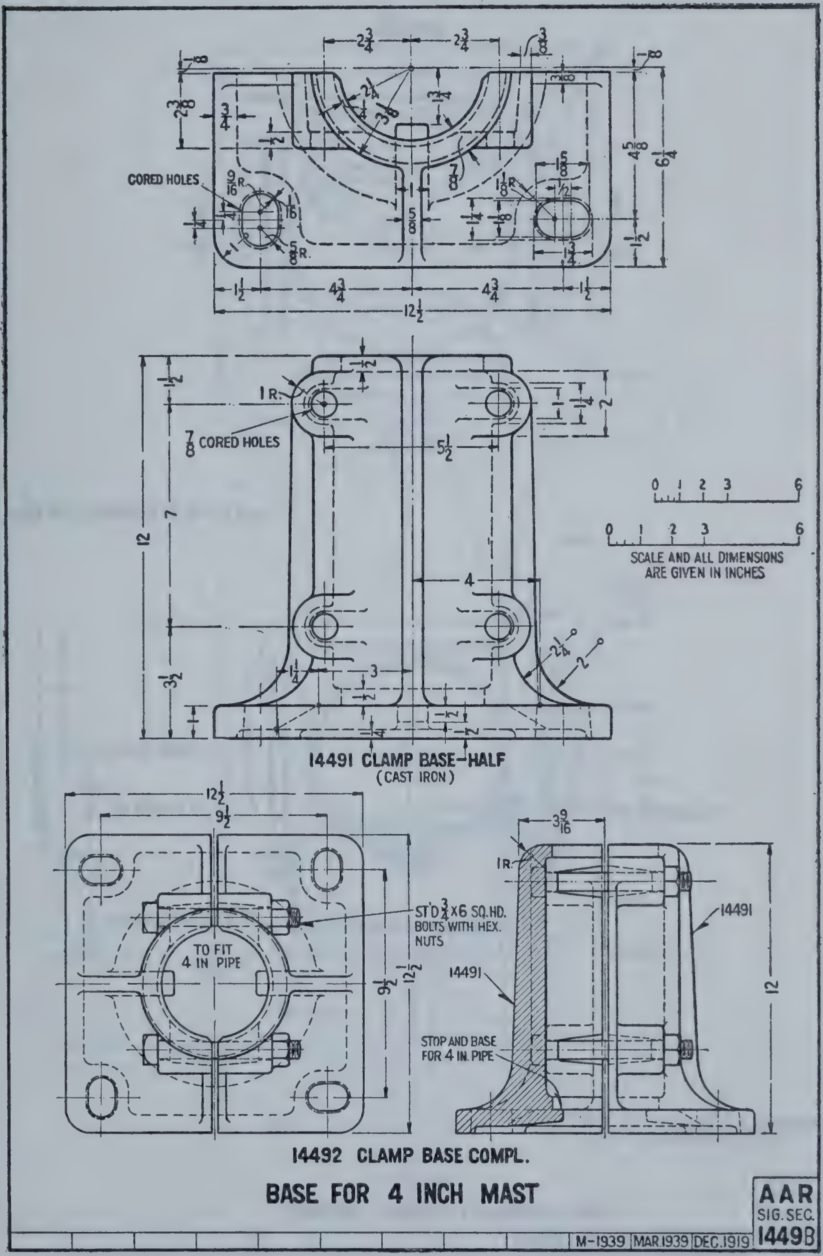
14461 LAMP CASE WITH CONVEX ROUNDEL
14462 LAMP CASE WITH FLAT ROUNDEL
(CAST IRON)

ELECTRIC LAMP CASE
FOR SEMAPHORE LIGHTING

AAR SIG.SEC. 1446A
M-1937 MAR 1937

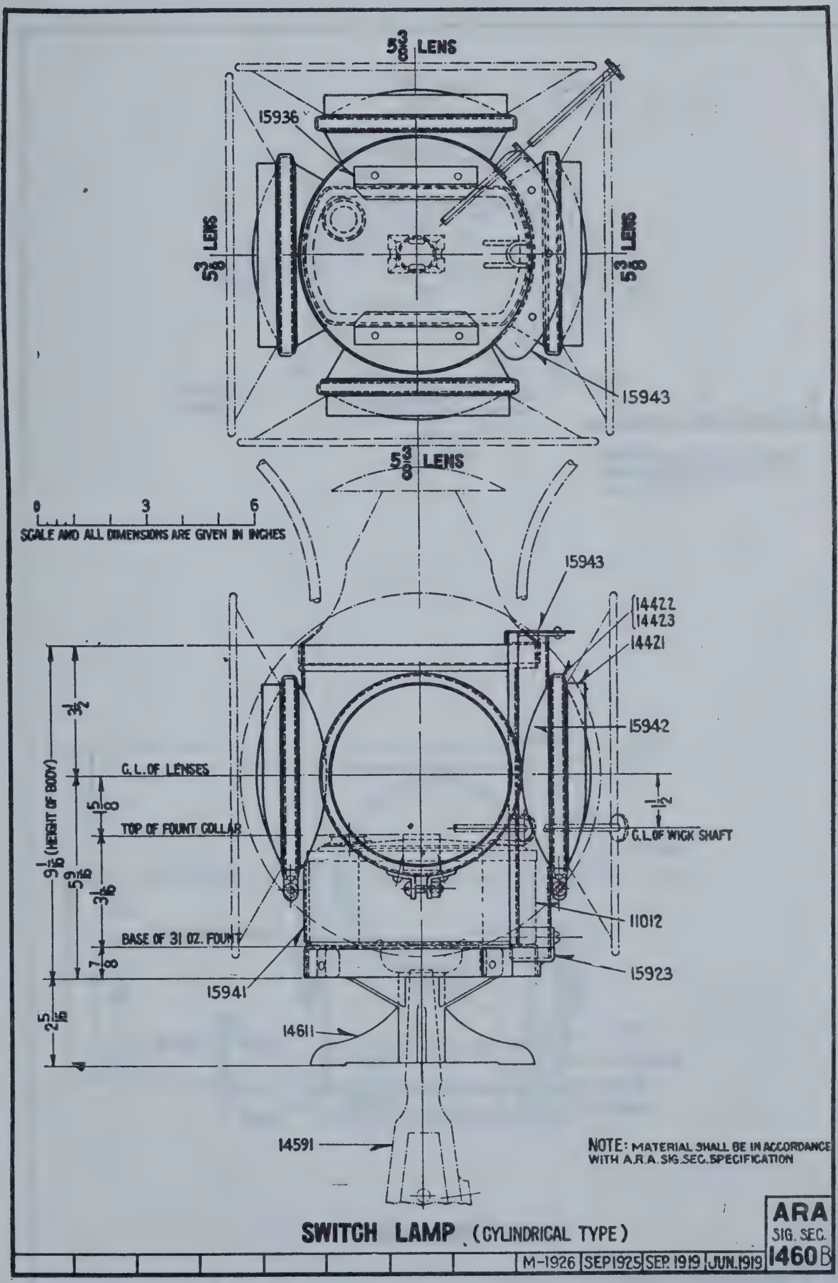
Material shall be in accordance with Specification 174 and Specification for Gray Iron Castings.

Official Approval, Mar. 1921, July 1939.


CORED HOLES
$\frac{7}{8}$ CORED HOLES
14491 CLAMP BASE-HALF
(CAST IRON)
SCALE AND ALL DIMENSIONS ARE GIVEN IN INCHES
TO FIT 4 IN. PIPE
ST'D $\frac{3}{4}$ X 6 SQ. HD. BOLTS WITH HEX. NUTS
14491
STOP AND BASE FOR 4 IN. PIPE
14492 CLAMP BASE COMPL.
BASE FOR 4 INCH MAST
AAR
SIG. SEC.
1449B
M-1939
MAR.1939
DEC.1919

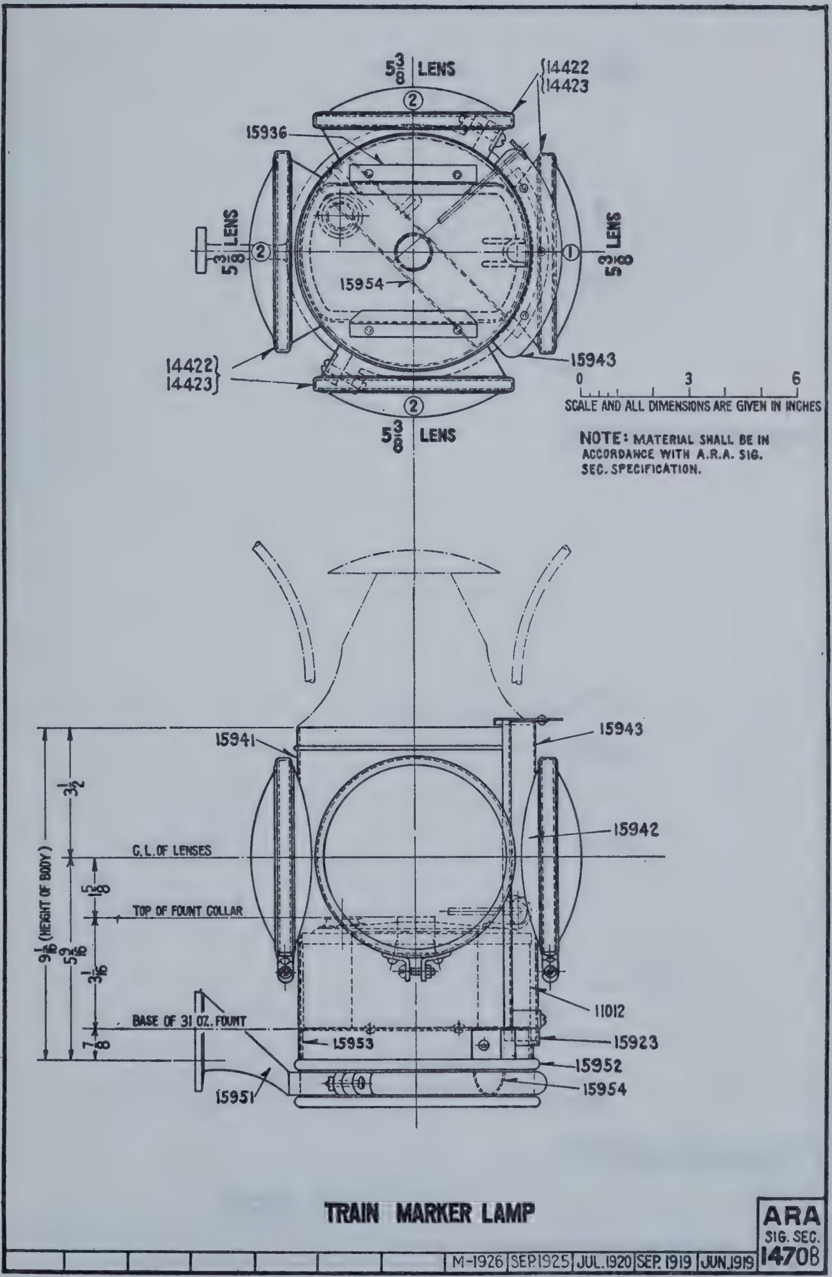
Cast iron shall be in accordance with Specification for Gray Iron Castings.

Official Approval, July 1926.


5 3/8 LENS
15936
5 3/8 LENS
5 3/8 LENS
15943
5 3/8 LENS
0 3 6
SCALE AND ALL DIMENSIONS ARE GIVEN IN INCHES
15943
14422
14423
14421
15942
3 1/2
9 1/16 (HEIGHT OF BODY)
G.L. OF LENSES
1 1/2
5/8
TOP OF FOUNT COLLAR
G.L. OF WICK SHAFT
5 9/16
3 1/16
11012
BASE OF 31 OZ. FOUNT
7/8
15923
15941
2 5/16
14611
14591
NOTE: MATERIAL SHALL BE IN ACCORDANCE WITH A.R.A. SIG. SEC. SPECIFICATION
SWITCH LAMP (CYLINDRICAL TYPE)
ARA
SIG. SEC.
1460B
M-1926
SEP 1925
SEP. 1919
JUN. 1919

Material shall be in accordance with Specification 137.

Official
Approval,
Mar. 1921,
July 1926.

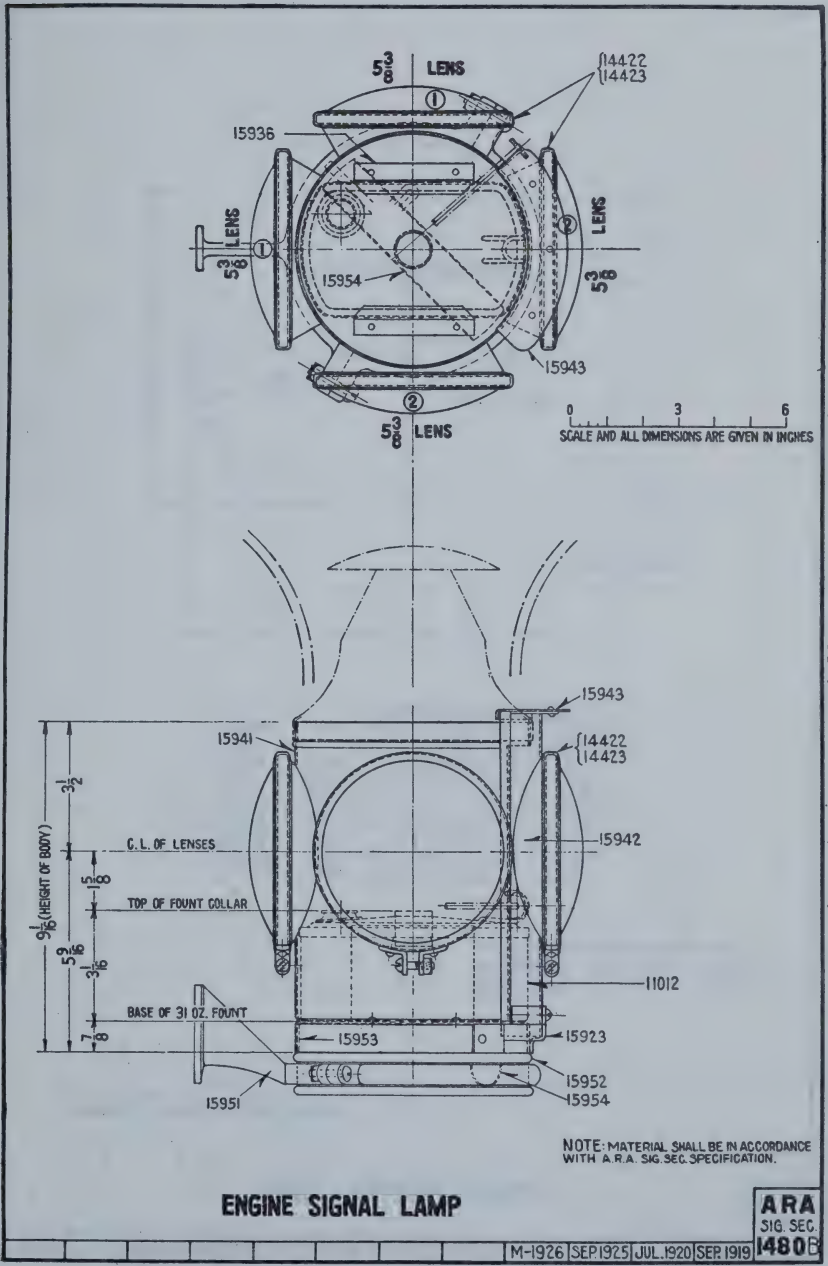

5 3/8 LENS
14422
14423
15936
②
①
15954
15943
0
3
6
SCALE AND ALL DIMENSIONS ARE GIVEN IN INCHES
15941
15942
C.L. OF LENSES
TOP OF FOUNT COLLAR
BASE OF 31 OZ. FOUNT
3 1/2
9 1/16 (HEIGHT OF BODY)
5 9/16
1 5/8
3 1/16
7/8
11012
15923
15953
15952
15951
M-1926
SEP.1925
JUL.1920
SEP.1919
JUN.1919
ARA
SIG. SEC.
1470B

NOTE: MATERIAL SHALL BE IN ACCORDANCE WITH A.R.A. SIG. SEC. SPECIFICATION.

TRAIN MARKER LAMP

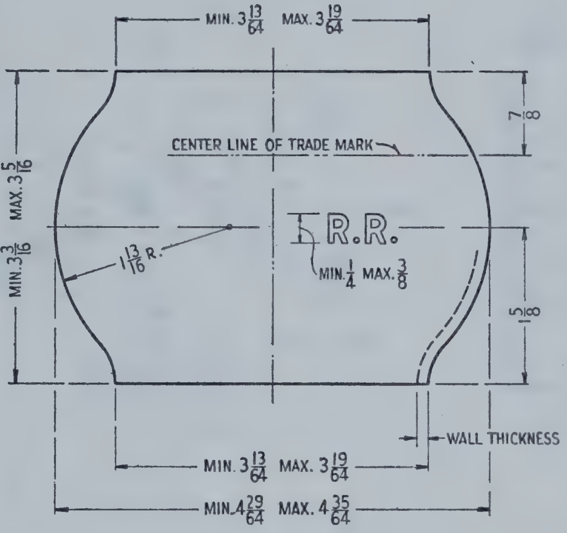
Material shall be in accordance with Specification 137.

Official Approval, Mar. 1921, July 1926.


5 3/8 LENS
14422
14423
15936
LENS 5 3/8
LENS 5 3/8
15954
15943
5 3/8 LENS
0 3 6
SCALE AND ALL DIMENSIONS ARE GIVEN IN INCHES
15943
15941
14422
14423
15942
3 1/2
C. L. OF LENSES
1 5/8
TOP OF FOUNT COLLAR
9 1/16 (HEIGHT OF BODY)
5 9/16
3 1/16
11012
BASE OF 31 OZ. FOUNT
7/8
15953
15923
15952
15954
15951
NOTE: MATERIAL SHALL BE IN ACCORDANCE WITH A.R.A. SIG. SEC. SPECIFICATION.
ENGINE SIGNAL LAMP
ARA SIG. SEC. 1480B
M-1926
SEP. 1925
JUL. 1920
SEP. 1919

Material shall be in accordance with Specification 137.

Official Approval, July 1927, July 1929, Sept. 1933, July 1939.


MIN. 3 13/64 MAX. 3 19/64
MAX. 3 5/16
MIN. 3 3/16
7/8
CENTER LINE OF TRADE MARK
R.R.
MIN. 1/4 MAX. 3/8
1 13/16 R.
1 5/8
WALL THICKNESS
MIN. 3 13/64 MAX. 3 19/64
MIN. 4 29/64 MAX. 4 35/64

GLOBE	COLOR	WALL THICKNESS		WEIGHT-OZ.	
		MIN.	MAX.	MIN.	MAX.
16116	CLEAR	3/32	7/32	5.0	9.0
16117	RED	"	"	5.5	10.5
16118	YELLOW	"	"	5.5	10.5
16119	BLUE	5/64	1/4	*	*
161110	GREEN	"	"	*	*

NOTE: * WAIVED ON ACCOUNT OF MANUFACTURING REQUIREMENTS. WALL THICKNESS MEASURED AT ENDS ONLY

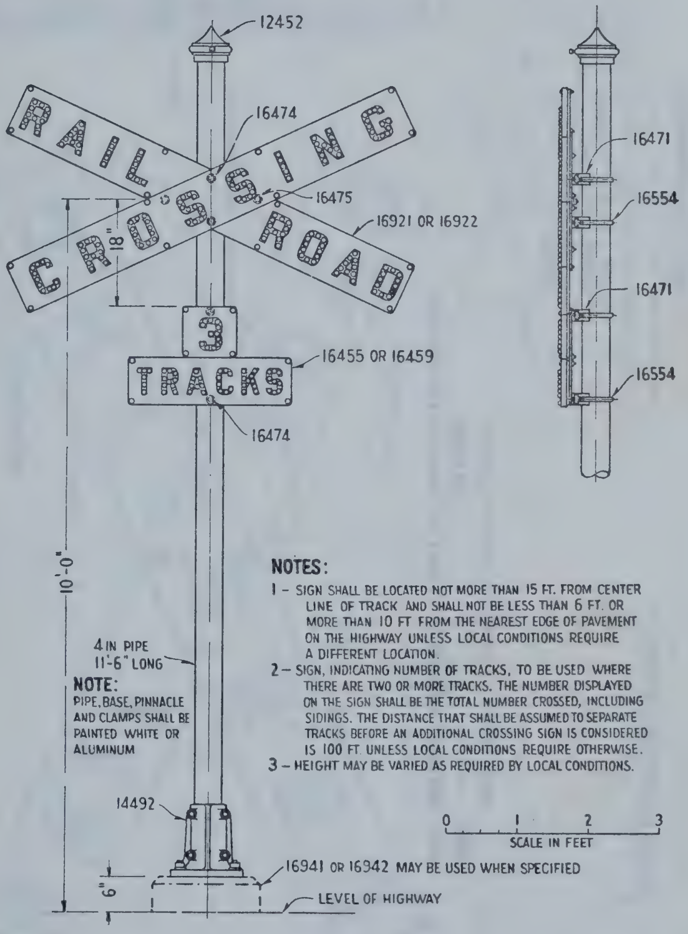
0 1 2 3
SCALE AND ALL DIMENSIONS GIVEN IN INCHES

HAND LANTERN GLOBES

AAR
SIG. SEC.
1611D

M-1939 | MAR.1939 | M-1933 | MAY 1933 | M-1929 | MAR 1929 | SEP. 1928 | M-1927 | SEP. 1926

Material shall be in accordance with Specification 59.


12452
RAIL ROAD
CROSSING
16474
16475
16921 OR 16922
18"
3
TRACKS
16455 OR 16459
16474
16471
16554
16471
16554
10'-0"
4 IN PIPE
11'-6" LONG
14492
16941 OR 16942 MAY BE USED WHEN SPECIFIED
6"
LEVEL OF HIGHWAY
0 1 2 3
SCALE IN FEET

NOTE:
PIPE, BASE, PINNACLE AND CLAMPS SHALL BE PAINTED WHITE OR ALUMINUM

NOTES:

1 – SIGN SHALL BE LOCATED NOT MORE THAN 15 FT. FROM CENTER LINE OF TRACK AND SHALL NOT BE LESS THAN 6 FT. OR MORE THAN 10 FT. FROM THE NEAREST EDGE OF PAVEMENT ON THE HIGHWAY UNLESS LOCAL CONDITIONS REQUIRE A DIFFERENT LOCATION.

2 – SIGN, INDICATING NUMBER OF TRACKS, TO BE USED WHERE THERE ARE TWO OR MORE TRACKS. THE NUMBER DISPLAYED ON THE SIGN SHALL BE THE TOTAL NUMBER CROSSED, INCLUDING SIDINGS. THE DISTANCE THAT SHALL BE ASSUMED TO SEPARATE TRACKS BEFORE AN ADDITIONAL CROSSING SIGN IS CONSIDERED IS 100 FT. UNLESS LOCAL CONDITIONS REQUIRE OTHERWISE.

3 – HEIGHT MAY BE VARIED AS REQUIRED BY LOCAL CONDITIONS.

16911 ASSEMBLY AS SHOWN, — SYNTHETIC ENAMEL FINISH ON SIGNS
16912 " WITHOUT 16455 " " " " "
16913 " AS SHOWN, — VITREOUS " " " "
16914 " WITHOUT 16459 " " " " "

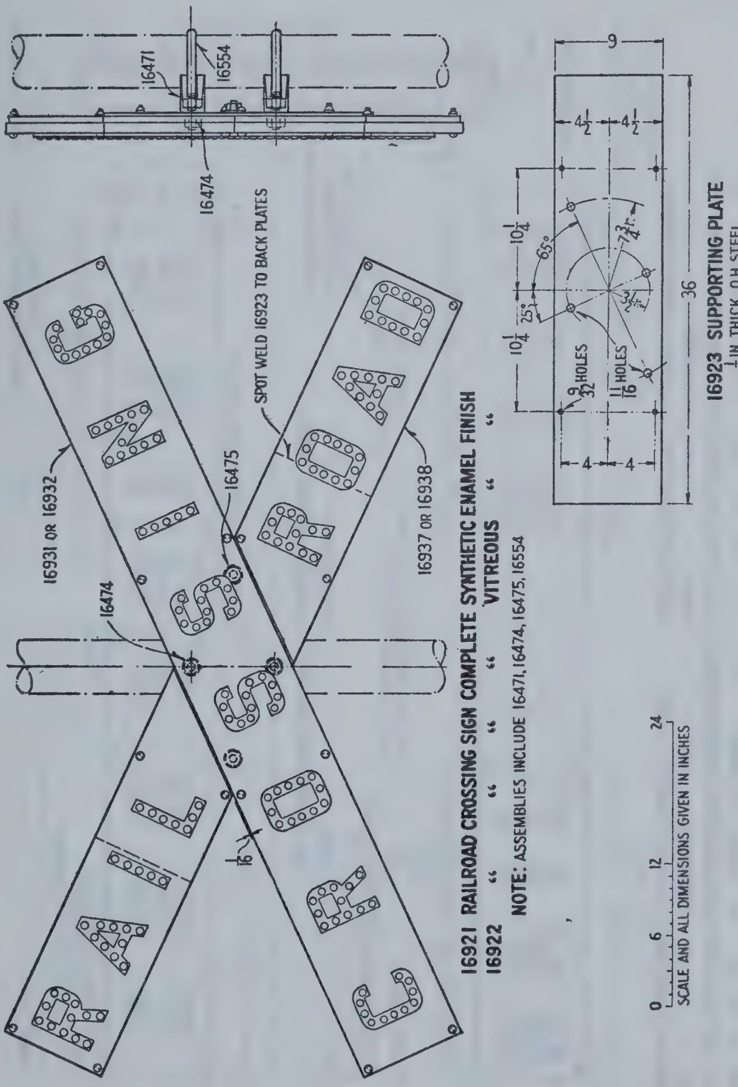
HIGHWAY CROSSING SIGN

50° REFLECTOR TYPE

M-1939 MAR 1939

AAR
SIG. SEC.
1691A

Official Approval, July 1939.


16471
16554
16474
SPOT WELD 16923 TO BACK PLATES
16475
16931 OR 16932
16937 OR 16938
16474
1/16
RAILROAD
CROSSING
9
4 1/2
4 1/2
10 1/4
10 1/4
65°
25°
7 3/4 r.
3 1/2
9/32 HOLES
11/16 HOLES
4
4
36
16923 SUPPORTING PLATE
1/4 IN. THICK, O.H. STEEL
0
6
12
24
SCALE AND ALL DIMENSIONS GIVEN IN INCHES

16921 RAILROAD CROSSING SIGN COMPLETE SYNTHETIC ENAMEL FINISH
16922 " " " " VITREOUS "

NOTE: ASSEMBLIES INCLUDE 16471, 16474, 16475, 16554

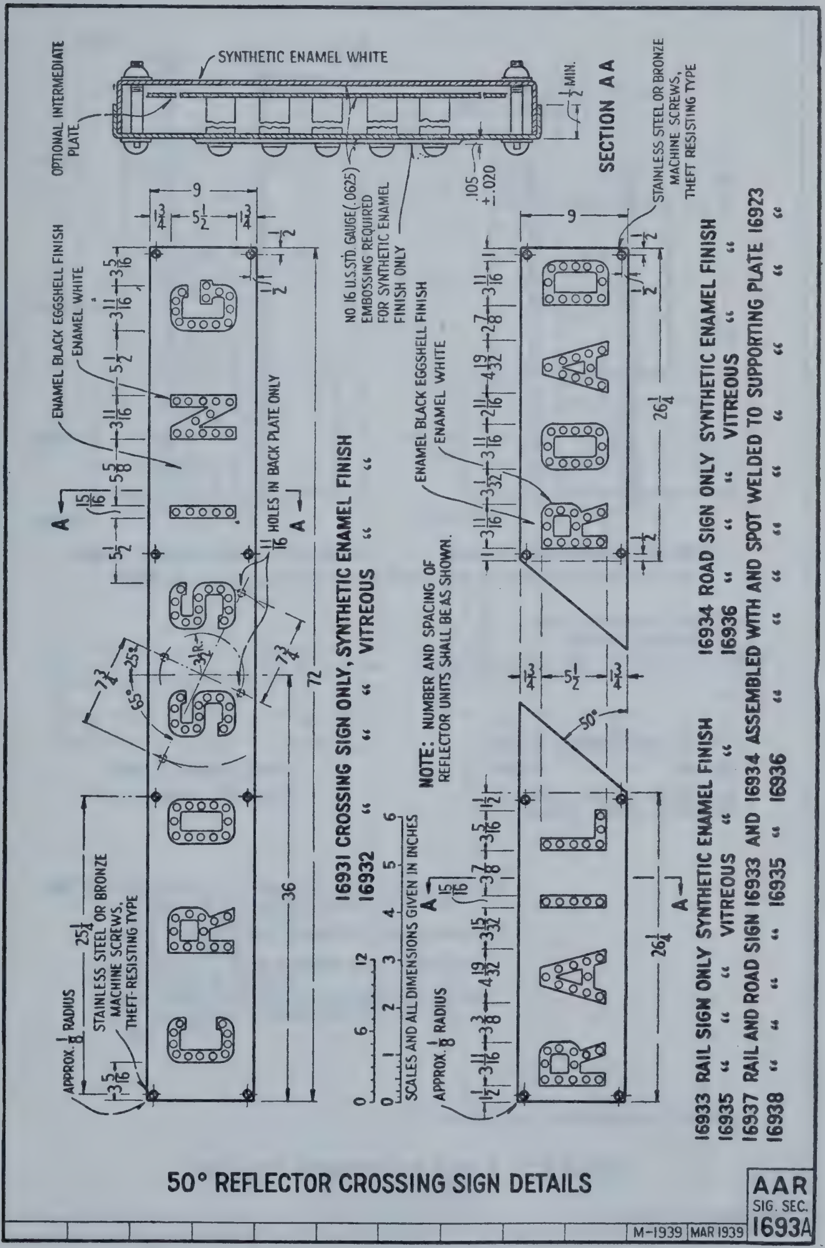
50° REFLECTOR CROSSING SIGN ASSEMBLY

AAR SIG. SEC. 1692A

M-1939 MAR 1939

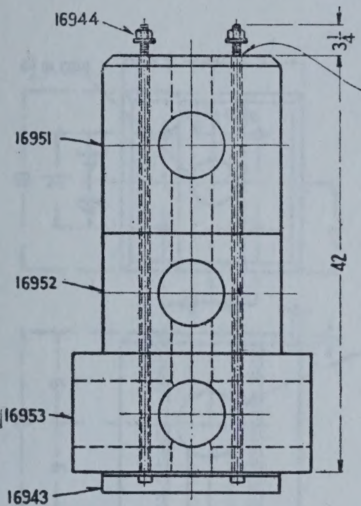
Material shall be in accordance with Specifications 155 and 156.

Official Approval, July 1939.

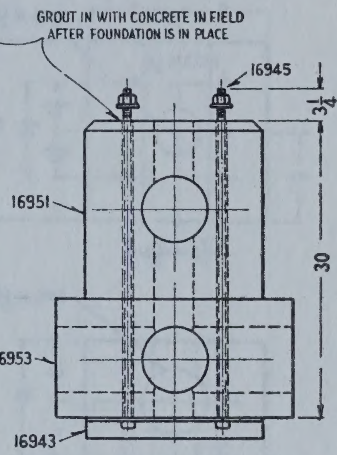

OPTIONAL INTERMEDIATE PLATE
SYNTHETIC ENAMEL WHITE
1/2 MIN.
SECTION A A
STAINLESS STEEL OR BRONZE MACHINE SCREWS, THEFT RESISTING TYPE
.105 ± .020
NO 16 U.S.STD. GAUGE (.0625) EMBOSSING REQUIRED FOR SYNTHETIC ENAMEL FINISH ONLY
ENAMEL BLACK EGGSHELL FINISH
ENAMEL WHITE
11/16 HOLES IN BACK PLATE ONLY
STAINLESS STEEL OR BRONZE MACHINE SCREWS, THEFT-RESISTING TYPE
APPROX. 1/8 RADIUS
CROSSING
RAIL
ROAD
A
A
72
36
25 1/4
26 1/4
9
50°
65°
25°
7 3/4
3 1/4 R
16931 CROSSING SIGN ONLY, SYNTHETIC ENAMEL FINISH
16932 " " VITREOUS "
NOTE: NUMBER AND SPACING OF REFLECTOR UNITS SHALL BE AS SHOWN.
SCALES AND ALL DIMENSIONS GIVEN IN INCHES
16933 RAIL SIGN ONLY SYNTHETIC ENAMEL FINISH
16935 " " " VITREOUS "
16937 RAIL AND ROAD SIGN 16933 AND 16934 ASSEMBLED WITH AND SPOT WELDED TO SUPPORTING PLATE 16923
16938 " " " " 16935 " 16936 " " " " " " "
16934 ROAD SIGN ONLY SYNTHETIC ENAMEL FINISH
16936 " " " VITREOUS "
50° REFLECTOR CROSSING SIGN DETAILS
AAR
SIG. SEC.
1693A
M-1939
MAR 1939

Material shall be in accordance with Specifications 155 and 156.

Official Approval, July 1939.

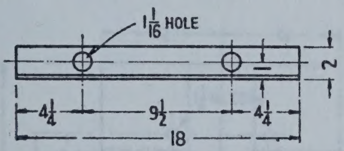

16944
3¼
16951
16952
42
16953
16943

16941 3 UNIT FOUNDATION COMPL.


GROUT IN WITH CONCRETE IN FIELD AFTER FOUNDATION IS IN PLACE
16945
3¼
16951
30
16953
16943

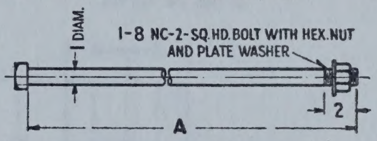
16942 2 UNIT FOUNDATION COMPL.

NOTE: BOLTS AND ANGLE IRON SHALL BE PAINTED WITH ASPHALT PAINT BEFORE ASSEMBLY.


$1\frac{1}{16}$ HOLE
2
$4\frac{1}{4}$
$9\frac{1}{2}$
$4\frac{1}{4}$
18

16943 ANCHOR IRON

$1\frac{1}{2}$ X 2 X $\frac{1}{4}$ ANGLE 2.77 LB. PER FT.

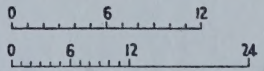

1 DIAM.
1-8 NC-2-SQ.HD. BOLT WITH HEX.NUT AND PLATE WASHER
2
A

16944 ANCHOR BOLT - A = $45\frac{1}{2}$

16945 " " - A = $33\frac{1}{2}$

O.H. STEEL GALVANIZED OR CADMIUM PLATED AFTER THREADS HAVE BEEN CUT

NOTE: FOUNDATIONS SHALL BE MADE OF PORTLAND CEMENT CONCRETE IN ACCORDANCE WITH AMERICAN RAILWAY ENGINEERING ASSOCIATION SPECIFICATION.
COARSE AGGREGATE SHALL CONSIST OF $\frac{3}{4}$ INCH MAXIMUM SIZE STONE OR GRAVEL.
NOT LESS THAN 6 SACKS OF CEMENT SHALL BE USED PER CUBIC YARD OF CONCRETE.
WATER CEMENT RATIO TO PRODUCE A COMPRESSIVE STRENGTH OF 2500 POUNDS PER SQUARE INCH AFTER 28 DAYS SHALL BE USED.


0
6
12
0
6
12
24

SCALES AND ALL DIMENSIONS GIVEN IN INCHES

PRECAST FOUNDATION FOR 4 INCH MAST

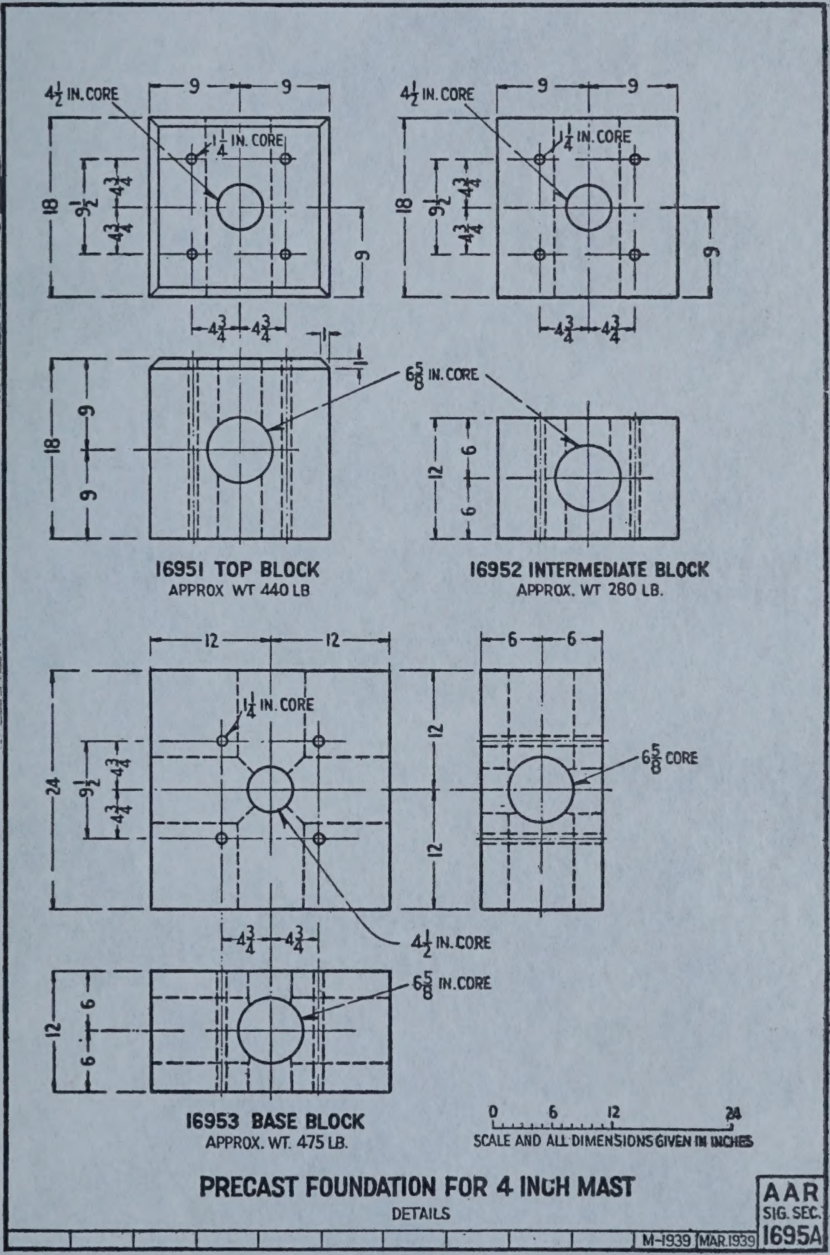
DETAILS AND ASSEMBLIES

AAR
SIG. SEC.
1694A

M-1939 MAR 1939

PRINTED IN U. S. A.

Official Approval, July 1939.


4½ IN. CORE
1¼ IN. CORE
9
9
18
9½
4¾
4¾
9
4¾
4¾
1
1
6⅝ IN. CORE
18
9
9
12
6
6
16951 TOP BLOCK
APPROX WT 440 LB
16952 INTERMEDIATE BLOCK
APPROX. WT 280 LB.
12
12
6
6
1¼ IN. CORE
24
9½
4¾
4¾
12
12
6⅝ CORE
4¾
4¾
4½ IN. CORE
6⅝ IN. CORE
12
6
6
16953 BASE BLOCK
APPROX. WT. 475 LB.
0
6
12
24
SCALE AND ALL DIMENSIONS GIVEN IN INCHES
AAR
SIG. SEC.
1695A
M-1939
MAR. 1939

PRECAST FOUNDATION FOR 4 INCH MAST
DETAILS